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The effect of grammar on composition skills was investigated. The type of grammar under experiment is "generative" grammar which is concerned with the psychological process of producing sentences. In this study generative grammar was taught to ninth- and tenth-grade students. There were several specific questions guiding this study: Can high-school pupils learn to apply the rules of a generative grammar in their writing? Can their repertoire of grammatical structures be increased by a study of generative grammar? To what extent will the proportion of well-formed sentences increase in pupil writing over the two-year period? What kind of error will occur in student writing, and to what extent will such errors increase or diminish over the two-year period?

Several conclusions were drawn: First, high-school students can learn the principles of generative grammar relatively easily because of its consistency, specificity, and relevance to well-formed sentence production. Second, a knowledge of generative grammar enables students to increase significantly the proportion of well-formed sentences they write. Third, it is suggested, but not proved, that there is a relation between a knowledge of generative grammar and an ability to produce well-formed sentences of greater structural complexity. Finally, a knowledge of generative grammar can enable students to reduce the occurrence of errors in their writing.

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The Effect of a Knowledge of Generative Grammar upon the Growth of Language Complexity

Cooperative Research Project No. 1746

by

Donald R. Bateman
and
Frank J. Zidonis



The Ohio State University
Research Foundation
Columbus, Ohio

1964

THE EFFECT OF A KNOWLEDGE OF GENERATIVE GRAMMAR
UPON THE GROWTH OF LANGUAGE COMPLEXITY

COOPERATIVE RESEARCH PROJECT #1746

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1. INTRODUCTION

Statement of Problem

Every composition teacher deals directly with the structure of English. Whether he relegates the role of language to a mere communicative function where it becomes a vehicle or a container into which the substance of content or ideas is poured or whether he believes that language can shape ideas as well as convey them, he must nevertheless have some means whereby he can talk about language with his pupils. The metalanguages he has espoused in the past have proved inadequate:

Formal Grammar - the rote memorization of rules of a grammar more Graeco-Roman than English,

Functional Grammar - ad hoc excerpts from the discredited Formal Grammar designed to explain correct usage choices, and

Corrective Grammar - the grammar commonly treated in the popular language series prepared for high schools. It leans heavily on Functional Grammar - when it deals with grammar at all - and it is the grammar most teachers of English think of under the term, Traditional Grammar.

It now seems abundantly clear that these fragmented, pre-scientific grammars are only indirectly related to the structure of English.

The classroom teacher of composition was unjustifiably optimistic in assuming that by studying the terms and concepts of these grammars his pupils would develop insight into the complex workings of English structures.

Thus even the teacher trained to use all the grammatical equipment available to him would not be able to help his pupils write

better sentences. Good, acceptable, well-formed sentences are by definition grammatical sentences. The pseudo-grammars alluded to above do not account for the ways in which sentences are produced; in fact, they can offer no grammatical explanation for the process of sentence formation because they are classificatory schemes that deal only with already produced sentences. Structural grammar likewise shares this classificatory impediment. Though these various schemes do provide some sort of basic terminology by which teacher and pupils can discuss their writing, they are not held together by any linguistic theory that would provide some fuller understanding of the way language actually works. Moreover, they offer no grammatical basis for rejecting as a sentence a group of words like The tree is remarkably intelligent. A grammar should be fully able to account for the native speaker's ability to produce novel sentences in infinite variety. Grammars that fail to do so, or fail even to strive to do so, must be of dubious value for the classroom teacher of composition.

With the advent of generative grammar, which is in essence a representation of the psychological process of producing sentences, a logical approach to the study of composition has become available. It is the goal of a generative grammar to specify the well-formed and only the well-formed sentences of English. The composition teacher has always striven to get his pupils to write better sentences, but he has had no procedure whatsoever for explaining to them just what the concept sentence contains. A pupil who has only a vague notion of sentencehood is doubtless at a disadvantage in evaluating the

quality of the sentences he has produced or in understanding the constructive criticisms of them offered by his teacher. Conscious control of well-formed sentences seems fundamental to the act of writing; but what is not understood can hardly be controlled. Pupils must be taught a system that accounts for well-formed sentences before they can be expected to produce more of such sentences themselves. It is the function of a complete grammatical system to define the concept of sentencehood; consequently all efforts to deal with punctuation, sentence fragments, and run-on sentences without recourse to an adequate grammar must fail. Fragments of grammars - Functional Grammar, for example - applied to specific problems of composition etiquette as ad hoc solutions simply reveal a misunderstanding of the role grammar might play in language study. Such excerpted bits of grammatical lore tend to be modernized forms of the discredited eighteenth-century grammarian's authoritarian pronouncements: avoid splitting the infinitive, the subject of the gerund must be in the possessive case, two negatives make a positive. These pronouncements are based not on a theory of language so much as on the pontificator's understanding of the Graeco-Roman grammatical tradition. Their relevance for the English language is at least questionable; their usefulness in classroom study, highly suspect.

Granted that many purported grammars of English are inadequate and unscientific: Would the study of an adequate grammar of English prove worthwhile in the secondary school? Or is the extant research conclusive in its failure to establish a correlation between the study of grammar and the improvement of pupil writing? The first question can be answered only empirically; the latter can rather justifiably

be answered in the negative: Meckel (23), surveying the research done on grammar and compositional problems, concludes that "much of the earlier research on teaching grammar must be regarded as no longer of great significance outside the period in educational history which it represents." Of greater importance for the present is his statement that "research does not justify the conclusion that grammar should not be taught systemically." Lumsdaine (22) explains why much of this now-discredited research appeared to be definitive in its findings:

failure to disprove the null hypothesis leaves the experimenter . . . no defensible position except that of suspended judgment The temptation is great to translate the only defensible statement of findings -- namely, that the results merely fail to show evidence that there was a significant difference -- into some more equivocal and more palatable form, e.g., that "no significant difference was found to exist" . . . or simply that "the two treatments did not differ significantly" (with that last word often deleted in the final summary. . .).

The present study seeks to measure the effect that the teaching of a generative grammar has upon the writing of ninth and tenth graders. The specific questions guiding the study are these:

1. Can high-school pupils learn to apply the transformational rules of a generative grammar in their writing?
2. Can their repertoire of grammatical structures be increased by a study of generative grammar?
3. To what extent will the proportion of well-formed sentences increase in pupil writing over the two-year period?
4. What kinds of transformational errors will occur in pupil writing, and to what extent will such errors increase or diminish over the two-year period?

Related Research

Current research in composition seems to have provided little

of substance on which to build a sound program. Braddock (2), for example, in his comprehensive survey of the available research into written composition, concludes that today's research is "laced with dreams, prejudices, and makeshift operations." Much of the presently available research must be discounted. Meckel (23, p. 967) points out that there is now a substantial body of linguistic research and consequent insights into the nature of language in general and English in particular that "have caused many of the studies on the teaching of composition to lose the significance attributed to them in the past."

This substantial body of linguistic research may be sub-divided into two kinds of systematic grammars: analytic and synthetic. Analytic grammars are pre-scientific in that they are classificatory and deal exclusively with limited samples of the language. Analytic grammars, according to Teeter (25), have for their highest goal observational adequacy - a complete and error-free presentation of the data. Synthetic grammars, on the other hand, strive for the goal of descriptive adequacy when they account explicitly for the linguistic system underlying the data; they attain the highest goal, explanatory adequacy, to the extent that they are able to relate this linguistic system to a general theory of language. In the order of highest to lowest, linguists rank these goals as follows: (1) explanatory adequacy, (2) descriptive adequacy, and (3) observational adequacy.

In discussing procedures for evaluating grammars, Bach (1) demonstrates that the taxonomic and data-collecting activities of traditional and structural grammars fail to meet the test of adequacy.

In a review of Chomsky (4), Lees (20) deals extensively with the topic of grammatical adequacy. He concludes that the theoretical character of generative grammar and its consequent explanatory and predictive power promise to lead to new psychological insights into the nature of learning as well as more extensive understanding of the native speaker's capacity to produce an infinite number of the sentences of his language. Johnson (12-16) and Jenkins (10-11), in fact, are providing empirical evidence of the psychological reality of generative grammar theory. The hypothesis that the logical structure of a generative grammar is analogous to the psychological structure of the process of sentence production is becoming both speculatively and empirically compelling. Katz (17) further expounds the psychological reality of generative grammar theory. Hjelmslev (8) reasons, "A priori it would seem to be a generally valid thesis that for every process there is a corresponding system by which the process can be analyzed and described by means of a limited number of premises." As a model of the process of sentence formation, generative grammar should provide the most fruitful framework from which to investigate and modify the composing process.

Linguists like Chomsky (3, 4), Lees (19, 20), and Fillmore (5, 7), have already produced a substantial body of material in the writing of generative grammars of English. Though by no means to be considered complete grammars, these writings present a logical starting-point for the study of language and composition. A pedagogical grammar, derivative from these four segments of grammars, was developed so that high-school pupils in the present experiment could

study the process of sentence formation. A set of 46 generative rules has been used as the framework for describing the transformational history of the sentences that have been analyzed. This descriptive tool is an objective, largely mechanical device for identifying explicitly the grammatical components of each sentence produced. An analytical device of this sort could provide a scale of expected language growth for pupils at different grade levels. Such a scale would extend the earlier attempts of LaBrant (18) and Watts (26), who sought to provide a developmental scale of language growth within a pre-traditional grammatical framework, and the later studies of Strickland (24) and Loban (21), who described the complexity of speech and writing within a structural grammatical framework. Hunt (9), though using a transformational description of sentence structure, does not distinguish between well-formed and mal-formed sentences; his findings consequently do not seem useful for the development of a scale that would chart expected sentence formation behavior at the different grade levels.

Much of the research which has investigated the relationship between a knowledge of grammar and compositional skill has construed grammar in a popular, pre-scientific sense. Scientifically oriented educators can hardly be surprised that the experimental classes exposed to the study of a pre-scientific - hence, inconsistent - English grammar did not produce significantly better results than control classes that did not study such a grammar. The only lesson to be derived from such comparisons seems to be that even the diligent study of an inconsistent body of materials is no better than the total

abandonment of such study. What students are expected to learn and to apply is of utmost importance; yet this part of most experimental programs tends to be slighted - final reports of experiments seldom condescend to discuss this matter seriously. Does the frequent writing assignment prove to be superior to the infrequent one? Of course not: how could it be, unless something of substance was studied by the class? Is there any difference in student writing depending on whether the English teacher has a lay-reader? Of course not: again, how could there be, unless something of substance was studied by the students? Ability grouping, changing (usually limiting) class sizes, alternating grammar study with literature study, teacher-student conferences over writing, team teaching approaches - most of these experimental investigations suffer from an understandable but fundamentally unsound assumption. They all assume that the English teacher has some valuable lessons to teach in his composition class, if only certain distracting realities could be removed. These distractions invariably are reducible to one: the English teacher is overloaded. The more likely assumption is that at present, in truth, the English teacher does not have lessons of value to teach to his composition students. Without a procedure for helping students to write acceptable sentences, no composition program is likely to be significantly better or worse than any other. It is consequently not the least surprising that most of these experiments have inconclusive results, though frequently they are inaccurately reported as having negative results. Readers of research reports must be alert for such statistical hyperbole.

The composition teacher, not having been provided with an adequate theory of language (or grammar), is forced to develop or secure curricular

materials that will stimulate and challenge his students to write - hopefully, to write better. Disaffection with inadequate grammatical systems has led to the fairly widespread adoption of anthologies containing provocative essays which are intended to supply both topics for writing assignments and model sentences for student emulation. Again the role of the composition teacher becomes that of deadline-imposer, critic-reader, and theme grader. He seems to be incidental to whatever process it is that transforms a writer of fragments or poor sentences into a writer of acceptable prose. And he seems to be, unfortunately, a living indictment of researchers' failure to provide even modest support for the building of a suitable composition program. At the very least, such support would include the development of an adequate grammatical system.

Procedures

In order to test out the possible effects of a study of a generative grammar upon pupil writing over a two-year period, the investigators selected the ninth grade class at the University School of the Ohio State University. The ninth grade, and the following year the tenth grade, seemed desirable because these two grades typically embrace the heaviest emphasis on grammatical study in the secondary schools. The fifty pupils constituting the ninth grade were assigned randomly to two sections. Teachers from the Language Arts Area of the University School were likewise assigned randomly to the two classes. Both teachers were experienced and highly competent; as it happened the control teacher had an edge in experience, having served one summer as a TV Demonstration Teacher and another as a Master Teacher in the Harvard Graduate

School of Education. Each class studied what would be considered the regular curriculum at the school with this exception: the experimental class studied materials specially adapted by the investigators from the area of generative grammar; a condensation of this segment of the curriculum, with exercises and drills deleted, is presented in the next two chapters. Of the original fifty subjects in this two-year project, the experimental class lost five and the control class lost four.

Frequently when an experimental class receives a substantive treatment that the control class does not receive, the investigator has serious problems in evaluation. In the new physics curriculum developed by the Physical Science Study Committee, for example, students are led to discover principles of material forces like energy and power through exploration in the laboratory instead of merely verifying there the traditional technology they had been taught in class. The objectives of the new physics program differ markedly from the objectives of the old one; clearly, a single test cannot provide a measure for comparing the achievement of pupils pursuing one curriculum with that of those pursuing the other. But the teaching of generative grammar to the experimental section in this study did not complicate the evaluation problem at all. For this substantive treatment was a means toward the achievement of objectives compatible with those of every English composition class: the improvement of pupils' writing. The experimental class was required to learn rather thoroughly the special grammatical materials prepared by the investigators; what the investigators had designed to measure, however, was the grammatical quality of the sentences produced by both sections at the initial and terminal stages of the experiment. To compute the grammatical quality of every sentence

written in the samples of prose collected, the investigators developed an instrument of transformational analysis that could be applied in a reasonably mechanical way.

Written compositions were collected from both sections during the first three months of the first year and the last three months of the second year of the project. Both teachers met regularly with the investigators in order to standardize their writing assignments, which evolved by design out of their respective classroom concerns. One piece of writing was secured from each pupil approximately every two weeks during the collecting stages; thus each pupil produced on average twelve pieces of writing to be analyzed, six initially and six finally. Two copies of every paper were typed in order to facilitate the original analysis and the cross-checking. A count of the number of lines in the sample multiplied by the average number of words per line indicated that the prose analyzed comprised 70,000 words.

Prose Analysis

The investigators developed an analytical instrument that would objectively assess the grammatical quality of the sentences in the sample. According to the generative grammar espoused in this project, there are two kinds of sentences in English: kernel and complex. Transformational rules are used in order to produce all sentences other than kernel sentences. It seems possible therefore to describe the transformational history of the sentences in the sample by identifying the specific transformations used to form the complex sentences, all other sentences being by definition kernel sentences in this grammatical system. Forty-six transformational rules served to identify the grammatical operations that each sentence in the sample reflected. These

rules are of four types: Embedding, Conjoining, Deleting, and Simple. Embedding transformations - the largest type, containing thirty-six rules - were further organized according to their specific functions: Noun Expansion, Noun Replacement, Adjective Expansion, Verb Expansion, Adverbial Replacement, and Adverbial Expansion. Chapter 3 discusses these rules rather fully, but a list of them with examples underlined would illustrate the nature of the analytical instrument.

EMBEDDING TRANSFORMATIONS

Noun Expansion

1 - Relative Clause (Be):

I admire my English teacher, who is a scholar.

2 - Adjective (by deletion and obligatory placement):

A handsome lad.

3 - Relative Clause (Have):

The book, which had no index, proved useless.

4 - With-phrase (by simple transformation of ET-3):

A book with an index is needed.

5 - Relative Clause (V_b):

The boy who scored the touchdown was cheered.

6 - Gerundive Adjective (by deletion and optional placement):

A smiling girl.

7 - Compounds: He stepped into the bull ring.

8 - Genitives: The horse's mouth/ The mouth of the horse.

Noun Replacement

9 - That + S as subject:

That I am failing the course disturbs me.

10a- (That) S as object:

I know he is a diligent student.

10b- That + S as object:

I rejoice that he has made the team.

11 - WH + S as subject:

What he has already learned astonishes me.

12 - WH + S as object:

I know what annoys him.

13 - WH + Inf as subject:

What to visit at the Fair is a problem.

14 - WH + Inf as object:

My cousin knows what to visit.

15 - Nominal Inf of Obligation:

Here is a book for you to know.

16 - Inf as subject:

To appear on television is an exciting experience.

17 - Inf as object:

I tried to answer the question correctly.

18 - Inf of purpose:

The exercises are designed to help you.

19 - Gerundive Nominal:

Tom's hot-rodding disturbed his mother. / She objected
to his continuous complaining.

20 - Gerundive Nominal of Purpose:

I have a knack for getting into trouble.

21 - Abstrative Nominal:

His eagerness to depart surprised me. / I admired
the girl's reluctance to go.

Adjective Expansion

- 22 - Adjective + Inf: You are free to get an education.
- 23 - Adjective + That-clause: I am happy that you have enrolled.
- 24 - Adjective + Gerundive: Lures are excellent for catching fish.

Verb Expansion

- 25 - V_{Ta}: I caught him stealing the money.
- 26 - V_{Tb}: I prevented him from stealing the money.
- 27 - V_{Tc}: I advised him to return the money.
- 28 - V_{Td}: I considered him to be the thief.
- 29 - V_{Te}: I let him return the money.
- 30 - V_{Tf}: I called him a fool.
- 31 - V_{Tg}: I made him angry.
- 32 - V_{Th}: I put the car in the garage.
- 33 - V_{in} + C: I kept on talking.

Adverbial Replacement

- 34 - Adverbial Replacement in Loc, Tm, Mot, or Man:

You may go wherever you wish.

- 35 - Adverbial Replacement (¢):

He is happy because she smiled at him.

Adverbial Expansion

- 36 - Adverbial Expansion of Man + C:

The lawyer spoke so rapidly that he confused the jury.

CONJOINING TRANSFORMATIONS

- 37 - Conjoining: The boat sank but nobody drowned.

DELETING TRANSFORMATIONS

38 - Common elements deletion:

His lonely hotel room seemed cold and his lonely hotel room seemed damp.

39 - WH + BE deletion: The boy who is starting at quarterback is in my class.

40 - Adverbial embedment deletion:

As if he had been asked, he sat down to dinner with us.

SIMPLE TRANSFORMATIONS

41 - Passive:

The boy hit the ball -- The ball was hit (by the boy).

42 - It-Inversion: It is surprising that we won the game.43 - There-Inversion: There is a thief among us.44 - Question: Are you going to the game tomorrow?45 - Negation: He did not see the mirage in the desert.

46 - Negation-shift:

I advised him not to enroll -- I didn't (did not) advise him to enroll.

These forty-six grammatical structures are instrumental in the sentence evaluation techniques developed in the project, for they provide various scores for measuring the grammatical changes occurring over the two-year period in the pupils' writing. These structures, moreover, can be identified quite objectively in a sample of prose by analysts; and of course it is the use of these structures in writing that is measured - not the pupil's awareness of or ability to recall their labels. This particular means of sentence evaluation, therefore, is applicable to the writing produced in both the control and the experimental classes.

It measures the quality of writing independent of the instruction accorded each class.

SENTENCE EVALUATION TECHNIQUES

The Sentence Evaluation Techniques (SET) consist of three component scores:

- 1 - Structural Complexity Score (SCS)
- 2 - Proportion of Well-Formed Sentences (PWF)
- 3 - Error Change Score (ECS)

The SCS indicates the grammatical or structural richness of the sentences produced in the experiment; the PWF reveals the ratio of acceptable to unacceptable sentences; and the ECS shows the trend in the frequency and kinds of grammatical mis-operations that occurred in pupil writing.

Structural Complexity Score

The forty-six transformations identified in the generative grammar adapted for this study were used to reconstruct the transformational history of every sentence in the prose sample. This process of reconstruction reverses the proper grammatical function of the transformations, whose effect is regularly to create new sentences rather than to analyze ones already produced. When sentences have been properly - that is, grammatically - formed, however, they can routinely be reduced to the kernel sentences from which they have been produced; and the transformations that have been applied can likewise be identified. The number of grammatical operations that have taken place in a particular sentence, then, becomes a score that characterizes the structural complexity of that sentence. The lowest possible score is 1, which has been assigned to

a kernel sentence; the score for a complex sentence becomes 1 + the number of transformations it contains. Thus a sentence using two embedding transformations, one conjoining transformation, and one simple transformation receives an SCS of 5. The following sentences, excerpted from the sample, illustrate further the computing of the SCS; the number in parentheses indicates the SCS, and the number above a particular word identifies one of the transformations as listed on pages 12 to 14:

(1) The rain splattered at the window.

(3) Then at long last I could see the smoke rise from the
chimney of my house.

(5) As these thoughts passed through my now-numbed brain, I
did not notice the dull rumbling in the distance.

(7) Her hands, long and delicate-looking, have almond-shaped fingernails.

(11) Finally the pawns, whose initiative and number provide a
pattern of battle, are the brave protecting agents of
the more powerful forces of the army, despite their lack of
strength.

After every sentence was analyzed in this manner, the mean structural complexity score was computed for Before and After well-formed and Malformed sentences for each pupil. The principal comparison was then made by analysis of variance applied to the gains scores.

Tabulating the specific transformations that occurred in every

⁴⁵ car, she couldn't believe her eyes; ³⁷ ⁸ Susie's father was Negro also.
^{37*-35} ² (3*) Now Ires belonged somewhere, she had a real friend.

The number in parentheses preceding each sentence indicates the SCS for that sentence; the number above a particular word identifies the transformation being used. An asterisk following an SCS indicates a mal-formed sentence; an asterisk following a transformation number indicates that the transformation was mis-applied. Of the seven sentences presented above, the five well-formed sentences have SCS's of (7), (1), (3), (6), and (5); and the two mal-formed sentences have SCS's of (10*) and (3*). In the first mal-formed sentence, the 37* indicates that the conjoining transformation was not properly applied though one was needed; in the second mal-formed sentence, the 37*-35 indicates that a conjoining transformation was improperly used for an adverbial replacement. Dividing the total number of sentences into the number of well-formed sentences in this severely limited example produces a PWF (Proportion of Well-Formed Sentences) of .714.

Error Change Score

These five classes of errors - or grammatical mis-operations - were identified and tabulated:

1. Mis-application of a transformational operation.
2. Use of one transformation when another is required.
3. Use of a transformation when none should have been used.
4. Omission of a required transformation.
5. Co-occurrence error: the use of mutually exclusive grammatical elements in kernel sentences or in kernel sentences underlying complex sentences.

Chapter 3 sets forth the proper ways in which transformations are applied, but brief examples of the various classes of errors should be useful.

Class 1 Error: In the sentence, "While Carson Drew was working on a case, he sometimes let his daughter help him, who does a very good job," Transformation 5 has been misapplied. The placement of the relative clause must come directly after daughter.

Class 2 Error: Sentence (3*) above contains a Class 2 Error. The conjoining transformation was used instead of an adverbial replacement; one way of handling the sentence grammatically would have been to replace the comma with because.

Class 3 Error: In the sentence, "Such ideas have and can be found in many books," a common element deletion - Transformation 38 - has been applied to remove been after have. This transformation should not have been used.

Class 4 Error: In the sentence, "He always looks clean though that's one thing in his favor," a conjoining transformation is omitted. A semicolon after though would have made the sentence grammatically acceptable.

Class 5 Error: In the sentence, "As a youth, he was averse from reading his school assignments," averse from should have been averse to. A fragment like "The leaves falling from the trees," which does not have the complete verb phrase required by the phrase structure rules (see Chapter 2), also exemplifies this class of errors.

After all the occurrences of errors were identified for each subject in the study, the Before-scores were compared with the After-scores to determine what changes in error reduction had taken place.

The analysis of all the data and the interpretation of the findings of this study are presented in Chapter 4. Because this analysis has made use of an instrument derived from extant generative grammars, Chapters 2 and 3 take up in abbreviated form the Phrase Structure component of the generative grammar and, informally, the transformational component. These two chapters provide a sketchy but concrete indication of the nature of the special materials studied in the experimental class. Chapter 2, The Phrase Structure Component, explicates rather formally the rules of a generative grammar by which kernel sentences are produced. The burden of Chapter 3 is to show how complex sentences are formed in English by the application of transformational rules.

BIBLIOGRAPHY

1. Bach, Emmon. An Introduction to Transformational Grammars. Holt, Rinehart and Winston, Inc., 1964.
2. Braddock, Lloyd-Jones, and Schoer. Research in Written Composition. National Council of Teachers of English, Champaign, Illinois, 1963.
3. Chomsky, Noam. "Explanatory Models in Linguistics," in Ernest Nagel (ed.), Logic, Methodology, and Philosophy of Science. Stanford University Press, 1962.
4. _____. Syntactic Structures. Mouton and Company, 1956.
5. Fillmore, Charles J. Desentential Complement Verbs in English. The Ohio State University Research Foundation, GN 174, Report 1, April 1964.
6. _____. Indirect Object Constructions In English and the Ordering of Transformations. The Ohio State University Research Foundation, NSF-G18609, Report 1, February 1962.
7. _____. The Position of Embedding Transformations in a Grammar. The Ohio State University Research Foundation, NSF-G25055, Report 1, May 1963.
8. Hjelmslev, Louis. Prolegomena To a Theory of Language. The University of Wisconsin Press, Madison, 1961.

9. Hunt, Kellogg W. Differences in Grammatical Structures Written at Three Grade Levels. Florida State University, Cooperative Research Project 1998, 1964.
10. Jenkins, J. J. A Mediational Account of Grammatical Phenomena. J. Comm., in press.
11. Jenkins, J. J. and Palermo, D. S. Mediation Processes and The Acquisition of Linguistic Structure. Paper read at the Conferences on First-language Acquisition, Cambridge, October, 1961.
12. Johnson, Neal F. Linguistic Models and Functional Units of Language Behavior. The Ohio State University, 1964, mimeographed, 41 pages.
13. _____. The Influence of Associations Between Elements of Structured Verbal Responses. Department of Psychology, Columbus, The Ohio State University, 1964, mimeographed, 10 pages.
14. _____. The Integration of Subunits of Structured Responses. Department of Psychology, Columbus, The Ohio State University, 1964, mimeographed, 7 pages.
15. _____. On The Relationship Between Sentence Structure and the Latency in Generating the Sentence. Department of Psychology, Columbus, The Ohio State University, 1964, mimeographed, 9 pages.
16. _____. The Psychological Reality of Phrasestructure Rules. Unpublished manuscript, The Ohio State University, 1963.
17. _____. Katz, Jerrold J. "Mentalism In Linguistics," In Language, Vol. 40, No. 2, April-June 1964.
18. La Brant, Lou. "A Study of Certain Language Developments of Children in Grades Four to Twelve, Inclusive." Genetic Psychology Monographs, 14. (November, 1933) 387-491.
19. Lees, Robert B. "The Grammar of English Nominalizations," Supplement to International Journal of American Linguistics, 26, 1960.
20. _____. Review of Chomsky, Syntactic Structures, in Language, Vol. 33, No. 3 (Part 1) July-September 1957, p. 376.
21. Loban, Walter. "Language Ability in the Middle Grades of the Elementary School." Final Report to the U. S. Office of Education, Department of Health, Education, and Welfare, 1961, mimeographed, 145 pages.

22. Lumsdaine, A. A. "Instruments and Media of Instruction," in N. L. Gage (ed.), Handbook of Research on Teaching. Chicago: Rand McNally Company, 1963.
23. Meckel, Henry C. "Research on Teaching Composition and Literature," in N. L. Gage (ed.), Handbook of Research on Teaching. Chicago: Rand McNally Company, 1963.
24. Strickland, Ruth G.. "The Contribution of Structural Linguistics to the Teaching of Reading, Writing, and Grammar in the Elementary School," in Bulletin of the School of Education, Indiana University, Vol. 40, No. 1, January, 1964.
25. Teeter, Karl V. Review of Lili Rabel, Khasi, A Language of Assam, in Language, Vol. 39, No. 2 (Part 1), April-June 1963, pp. 342-3.
26. Watts, A. F. The Language and Mental Development of Children. London: D. C. Heath and Company, 1944.

2. THE PHRASE STRUCTURE COMPONENT OF A GENERATIVE GRAMMAR

It is customary to treat only the simple, affirmative, declarative sentences (kernel sentences) in the phrase structure component of a transformational generative grammar.* The reason for this is fairly simple: a careful description of the kernel sentences in English provides all the structures one needs in order to account for the formation of the complex structures. The phrase structure component (kernel grammar), though, must be developed in terms of the relationships that seem to hold between the simple and the complex structures. Hopefully, the ideal kernel grammar would provide the simplest base upon which to construct the other components of the grammar in the simplest way. It will be our intention to explore the rules of the kernel grammar in such a way that it will be possible to examine the transformational component of the grammar informally. The reason for treating the kernel grammar formally and the transformational rules informally is suggested by the somewhat specialized motivation of this study to provide an explication of a generative grammar that could be adapted to a study of stylistics in the junior high or high school English class. It is not our aim to make generative grammarians of the students, which would entail their writing generative grammars, but rather to help them become stylists who have expanded their capability of generating varied and well-formed sentences of the language. The requirement of learning how to reconstruct

* Readers of extant generative grammars will recognize the derivative character of these phrase structure rules and of the transformational rules presented in the following chapter. Those interested in the sources of generative grammar might examine Noam Chomsky's Syntactic Structures and his "A Transformational Approach to Syntax" in Third Texas Conference on Problems of Linguistic Analysis in English; Robert B. Lees' Grammar of English Nominalizations; and Charles Fillmore's Reports #1, 3, and 7 in Project on Linguistic Analysis, The Ohio State University Research Foundation. The main purpose of this manual is to develop a procedure for studying language structure with high school students. Lessons and exercises are therefore laid out in what seems to the authors to be a pedagogically justifiable order.

the transformational history of a complex sentence, which the student must learn to do in order to describe stylistic characteristics and well-formedness, is somewhat alien to a generative grammar, which generates sentences but does not analyze them. Consequently, one must understand how the grammar operates well enough to be able to reconstruct the steps through which a sentence has passed in its formation. Fairly extensive classroom exploration indicates that a kernel grammar can be taught rather easily in a formal, explicit way; only in this formal way can the significant characteristics of the theory underlying the grammar be adequately explored. Furthermore, an explicit account of the kernel sentences introduces the student to many of the transformational rules since the close relationship between the simple and the complex provides the basis for defining the terms of the grammar. When students can clearly distinguish between kernel and non-kernel sentences, the reconstruction of complex sentences becomes a simple matter.

Each term and each rule in an ordered set of rules cannot exist independently of the other terms and rules in the set. Consequently, the meaning of specific terms becomes increasingly clear as the set becomes more and more complete. A full understanding of a logical whole is only possible after the interrelationships that hold among the parts have been grasped. In an examination of a kernel grammar this problem is intensified by the fact that the kernel grammar cannot exist independently of the transformational component. We shall try to obviate this problem by fully discussing each rule as it appears, thus developing the characteristics of the total grammar informally as we develop the rules of the kernel grammar formally.

The first rule of the grammar states that the simple declarative

sentence S consists of a subject Nom and a predicate VP with the additional possibility of certain optional adverbial elements Adv.

(1) $S \rightarrow \text{Nom} + \text{VP} (\text{Adv})$

Rule (1) could be translated into natural language as follows: the symbol S, which stands for sentence, may be expanded into its constituent parts, which are, a subject (Nom) and a predicate (VP). Simple sentences of this type may also include certain adverbial constructions. The arrow stands for the operation of rewriting the symbol S into its component parts, the + indicates simply that the Nom may be separated from the VP, and the () indicates that the Adv is optional. The term Nom suggests nominal and the symbol VP suggests verb phrase.

Rule (1) permits us to analyze sentences as follows:

	<u>Nom</u>	<u>VP</u>
1 (a):	The boy	is happy.
(b):	The boy	became sick.
(c):	The boy	hit the ball.
(d):	The boy	became a man (at the game) (yesterday).

The exact specification of the constituents Nom and VP requires the expansion of these complex symbols into their constituent parts:

(2) $\text{VP} \rightarrow (\text{prev}) \text{ aux} + \text{MV}$

The VP constituent of simple declarative sentences can be expanded into an optional prev, which consists of a variety of affirmative and negative words (not, hardly, scarcely, seldom, almost, always, often) that appear usually before the verb; an auxiliary, aux, which will be expanded in Rule (33); and an MV, which includes a variety of classes of verbs and post-verbal structures. Before we can illustrate how Rule (2) expands our understanding of a kernel sentence, we must determine the

constituent parts of MV:

$$(3) \text{ MV } \longrightarrow \left\{ \begin{array}{l} \text{Be} + \text{pred} \\ V_b \end{array} \right\}$$

Rule (3) introduces a new symbol, braces, which mean "either-or."

In other words, at this stage our sentence-generating machine has an option: it may choose either Be + pred or V_b. It may seem strange to separate the verb Be from all other verbs in the language. This is not done arbitrarily, but is required by the structure of certain complex sentences in English which require Be as the finite verb in one of the kernel sentences of which the complex sentence is composed. For example, the reduced relative clause has its origin in a constituent sentence in Be:

3 (a): The boy (who is) on the corner became my friend.

The kernel sentences underlying this sentence are:

3 (b): The boy became my friend.
The boy is on the corner.

If we wished to formulate a rule which described the conditions under which the relative clause may be reduced, as it is in 3(a), it would be necessary to specify that the finite verb of the kernel sentence underlying the relative clause must be Be. There are other places in the transformational component of the grammar in which it is convenient to refer to all verbs other than Be.

An examination of many simple sentences containing Be as the finite verb indicates that pred may be an adjective, a noun, or an adverb of location:

$$(4) \text{ pred } \dashrightarrow \begin{Bmatrix} \text{Nom} \\ \text{Adj} \\ \text{Loc} \end{Bmatrix}$$

4 (a): The boy is the president.
 The boy is happy.
 The boy is here.

The term $\underline{V_b}$ may now be expanded:

$$(5) \underline{V_b} \dashrightarrow \left\{ \begin{array}{l} \begin{Bmatrix} \text{stay} \\ \text{remain} \end{Bmatrix} + \text{pred} \\ \text{become} + \begin{Bmatrix} \text{Adj} \\ \text{Nom} \end{Bmatrix} \\ V_L + \text{Adj} \\ V \end{array} \right\}$$

Since $\underline{V_b}$ has its origin in $\underline{VP}$, it should be remembered that the optional Adv in Rule 1 still applies to expansions of $\underline{VP}$. Consequently, it is possible to have additional optional adverbial elements following any of the sentences described by Rule (5). It should be noticed that Rule (5) specifies all the verbs that could not be classified as transitive, intransitive, or middle (i.e., verbs like have, weigh, resemble which have no passive form, as the transitive verbs do, but do not share characteristics with such verbs as Be, Become, Stay, and Remain, which also can have nouns as complements). In Rule (5) stay and remain share pred with Be but differ from Become, which cannot be followed by Loc, adverbials of location.

- 5(a): The boy stayed tired.
 The boy stayed there.
 The boy stayed president.
- (b): The boy remained happy.
 The boy remained there.
 The boy remained chairman.
- (c): The boy became tired (easily).
 The boy became a man (rapidly).
 *The boy became there. (The asterisk indicates a non-S.)

The optional adverbial elements that (Adv) provides for may be illustrated as follows:

- 5(d): The boy stayed tired (throughout the game).
 The boy remained happy (for many years).
 The boy became a man (rapidly) (during the tennis match).

The symbol V_L refers to all verbs that choose only Adj as post-verbal element:

- 5(e): The man felt tired.
 The horse turned blue.
 The balcony appeared strong.

Here, too, optional adverbial elements are possible.

A difficult pedagogical problem can occur, if it has not been anticipated, when the transitive or intransitive homophones of these verbs are cited as examples of V_L 's followed by nouns:

- 5(f): The man felt the cloth.
 The boy turned the key.
 My friend grows melons.
 George appeared at the game.

The problem can be avoided by showing that other V_L 's not having homophonous counterparts may be substituted in sentences of the type appearing in 5(e), but not in 5(f):

- 5(g): The man became tired.
 *The man became the cloth.
 The horse became blue.
 *The boy became the key.
 The balcony seemed strong.
 *George seemed at the game.

There are a number of other examples of homophony that a generative grammar clarifies by the explicit way in which parts of speech are specified. We will discuss these as we come to them.

We may now expand the symbol $\underline{V}$:

$$(6) \quad V \rightarrow \left\{ \begin{array}{l} \underline{V}_{int} \\ \underline{V}_{tr} + Nom \\ \underline{V}_{mid} + Nom \end{array} \right\} (Man)$$

Rule (6) divides the remaining verbs into three general classes: intransitive verbs ($\underline{V}_{int}$), which will be sub-divided in Rule (7); transitive verbs ($\underline{V}_{tr}$), which will be sub-divided in Rules (9), (10), and (11), and middle verbs ($\underline{V}_{mid}$). $\underline{V}_{int}$ and $\underline{V}_{tr}$ share an optional adverbial of manner. $\underline{V}_{tr}$ and $\underline{V}_{mid}$ share a Nom, though only the $\underline{V}_{tr}$ has a passive form.

$\underline{V}_{int}$ Man

6(a): The boy walked away (rapidly).

$\underline{V}_{tr}$

The boy hit the ball (hard). (Active)

The ball was hit by the boy. (Passive)

$\underline{V}_{mid}$

The boy resembles his mother.

*His mother is resembled by the boy.

$\underline{V}_{tr}$

The boy kissed the girl passionately.

*The boy resembles his mother quickly.

$$(7) \quad \underline{V}_{int} \rightarrow \left\{ \begin{array}{l} \underline{V}_i \\ \underline{V}_{iL} + Loc \\ \underline{V}_{iM} + Mot \end{array} \right\} (C)$$

Rule (7) expands V_{int} into V_1 's, which may have no post-verbal element (He sleeps); V_{iL} 's, which select adverbs of location (He sat on the house); and V_{iM} 's, which select adverbs of motion (He ran into the house). One of the purposes of Rule (7) is to show that there are no such sentences as *He sat into the house, *He stood into the room, and *He lies into the garage. Under certain circumstances intransitive verbs require either adverbs of motion or adverbs of location, but not both, and Rule (7) attempts to indicate that there are such restrictions in the language.

The symbol $\underline{C}$ appears as an undeveloped symbol in several places in the phrase structure grammar to allow for the possibility of such sentences as the following:

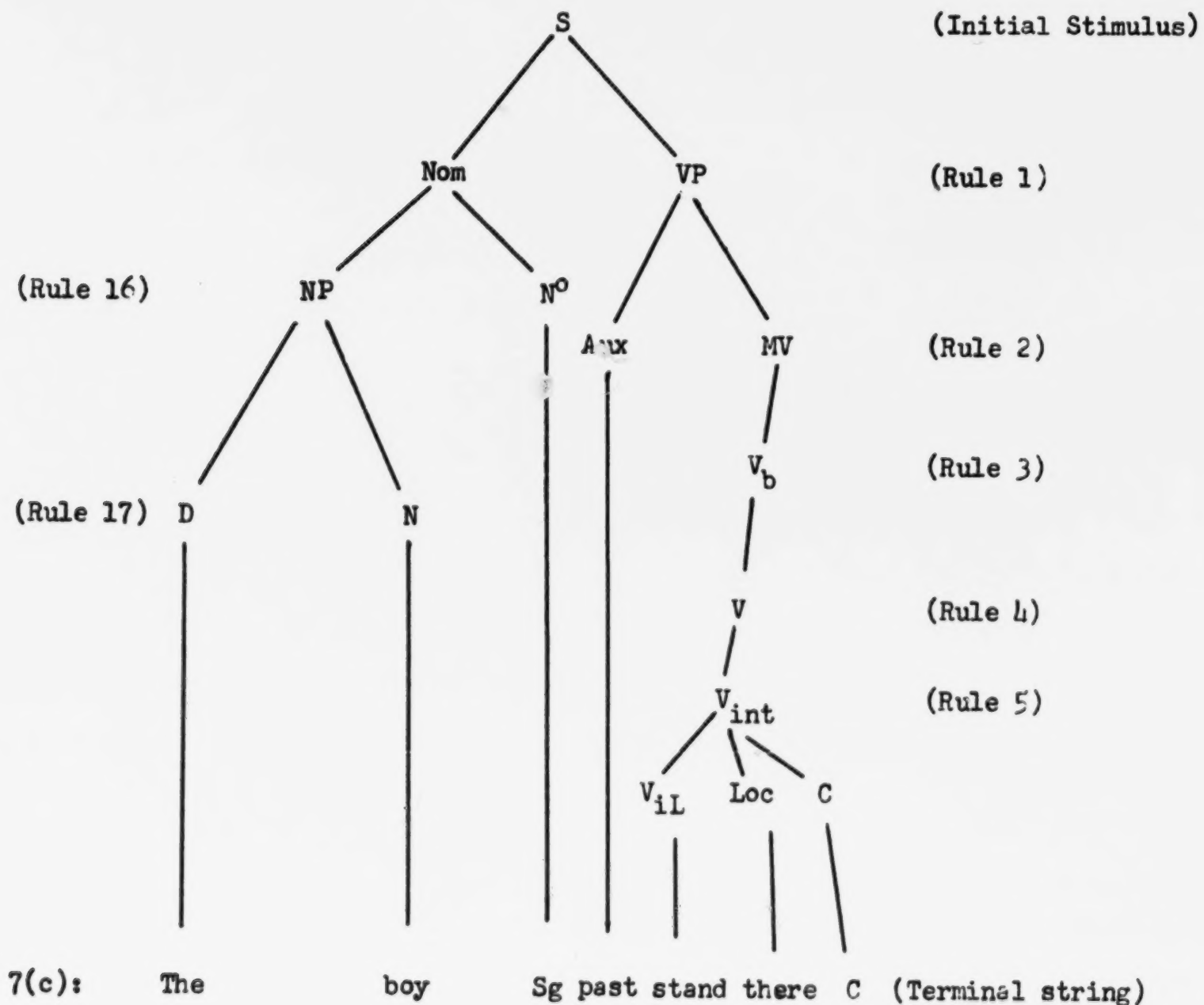
- 7(a): He stood there blinking.
 Crusoe lay there feeling thankful.
 John came running.
 Joe came to play.

V_{iL} 's and V_{iM} 's can frequently take a complement that has its origin in a second kernel sentence. In these cases it is often possible to delete the adverbial that appears between the intransitive verb and the complement:

- 7(b): He stood (there) blinking.
 John came (to our house) feeling happy.
 Joe came (to the game) to play.

If we regard a generative grammar as a device that generates sentences in an almost mechanical way (as a computer might), we must provide for levels of representation that precede an actual utterance. If we were to give the grammar a physiological interpretation, we could then say that a sentence is produced by applying a series of rules, beginning with S, which represents the initial urge to say something, through the ordered

set of rules which lead to a fully formulated utterance. As each rule is applied, the sentence is represented as a string of symbols, terminating in a pre-sentence, which may be represented morphophonemically as speech, or orthographically as writing. This process may be represented in the form of a tree as follows:



Presumably, then, this terminal string is stored until C is developed (in this case into ing + blink, from the kernel sentence he was blinking), producing the complex string the boy sg past stand there ing + blink, which may be orthographically represented as The boy stood there blinking.

Terminal strings such as 7(c) may seem obscure at first to one not familiar with the symbology of generative grammar. There are, however, extremely strong reasons for representing number, tense, and complement as symbols in a system. For example, the terminal string:

7(d): the boy sg past stand there C

may be transformed into

7(e): past the boy sg stand there C

This yes or no question results from a re-arranging of the elements of the terminal string, a process explicitly described and controlled by the question transformation rule. In short, the transformational rules are applied to terminal strings, not to the final utterances. The past morpheme in this terminal string is replaced by the proper form of the pro-verb do which replaces the orthographically unrepresentable symbol past. Thus the utterance, The boy stood there blinking, transforms finally into Did the boy stand there blinking?

We may now proceed with the development of the phrase structure component of the grammar by examining the expansion of V_{tr} :

$$(8) \quad V_{tr} \dashrightarrow \left\{ \begin{array}{l} V_t \\ V_X + P \\ V_T + C \end{array} \right\}$$

Rule (8) separates transitives with preposition complexes, $V_x + P$, and transitives which take complements $V_T + C$, from the other $V_{tr}'s$.

V_t

8(a): The boy hit the ball.

$V_x + P$

The boy looked at the girl.

$V_T + C$

The boy saw - approaching - his friend.

(The boy saw his friend approaching.)

Since transitives by definition are verbs which can be transformed into the passive, each sentence in 8(a) must have a passive form:

8(b): The ball was hit by the boy.

The girl was looked at by the boy.

His friend was seen approaching by the boy.

In accordance with Rule (6) each of the sentences in 8(a) could have an adverbial of manner:

8(c): The boy hit the ball (easily).

The boy looked at the girl (intensively).

The boy saw his friend approaching (rapidly).

Each of the sentences in 8(a) could be represented by a tree which would culminate in a terminal string:

8(d): The boy sg past hit the ball sg.

The boy sg past look at the girl sg.

The boy sg past see + C his friend sg.

The last string would become, by transformation:

8(e): The boy sg past see - ing + approach - his friend

which would represent the sentence

8(f): The boy saw his friend approaching.

8(e) bears a certain similarity to the comparable complement constructions generated by the selection of C in Rule (7), which produced the string

8(g): The boy sg past stand there - ing + blink

though 8(g) has no passive.

There are many possible constructions that have their origin in strings containing verbs of the class $V_T + C$. Since their formation requires a second kernel sentence which is combined with the first by transformation, we shall not examine these complex sentences until Chapter 3. The following sentences are illustrative of the variety of structures that may be formed from different sub-classes of $V_T + C$'s.

8(h): I heard John call.
 I asked John to call.
 I found John sleeping.
 I put the car in the garage.
 I called John a fool.
 I painted the house red.
 I knew the house to be red.
 I prevented John from risking his life.

A distinguishing feature of a generative grammar is the ease with which it can account for ambiguities that have a structural origin. If a sentence is ambiguous, a grammar ought to be able to account for the ambiguity. It should be possible to show that

8(i): We kept the car in the garage.

has more than one structural origin, that it is, in fact, ambiguous.

A structural grammarian would have no way to account for the fact that

8(i) may be understood in two ways (either: we kept the car in the garage rather than out of the garage or: we kept the car in the garage but we

sold the one parked in front of the house). The first interpretation requires us to regard kept as a $V_T + C$ (We kept - in the garage - the car) and the second requires us to regard kept as a simple V_t and in the garage as a reduced relative clause (We kept the car (which is) in the garage). The two sentences will also produce different passives:

8(j): The car in the garage was kept by us (not the one in the street).

The car was kept in the garage by us (not in the driveway).

In Rule (9) V_t 's are divided into four sub-classes:

$$(9) \quad V_t \longrightarrow \left\{ \begin{array}{l} V_A + \text{Mot} \\ V_B + \text{Prt (Mot)} \\ V_{\text{ticf}} \\ V_{\text{tn}} \end{array} \right\}$$

The $V_A + \text{Mot}$ will be expanded in Rule (10) into verbs that have indirect objects in to (V_{tiot} : I gave - to John - the ball) and verbs which have adverbials of motion ($V_A + \text{Mot}$: I drove - into the garage - the car). $V_B + \text{Prt}$'s are contrasted with $V_x + P$'s transformationally as follows:

$V_x + P$

9(a): He looked at the girl. --- *He looked the girl at.

$V_x + P$

He flirted with the girl. --- *He flirted the girl with.

$V_B + \text{Prt}$

He brought up the pop. --- He brought the pop up.

$V_B + \text{Prt}$

He put away the books. --- He put the books away.

Much of the structure of the kernel grammar is determined transformationally. Consequently it is always difficult to comprehend individual rules in the grammar without being familiar with the whole grammar. Conversely, it is difficult to understand the character of the whole grammar without knowing the individual rules. It is possible that the steps required to understand the workings of a model are analogically comparable to the steps the child passes through as he learns his native language. The child must revise his grammar in accordance with the constant corrections he receives from his parents and later from his teachers. This process seems to be a never-ending one, since we are never able to write or speak with the precision and accuracy we desire. In this sense it is misleading to say that the child has acquired virtually full command of the phonology, morphology, and syntax of his language by the age of five or six. The model of language that leads to this supposition can hardly be adequate.

Rule (9) also introduces V_{tiof} 's, transitive verbs that have indirect objects in for (I bought a hat for John).

Here again it will be possible to illustrate how the structure of the transformational component of the grammar determines and is determined by the phrase structure rules. The school text books customarily observe that there are indirect object in both to and for, though the grammatical characteristics of these constructions are not examined, and it is not noted that these are discrete classes of verbs, each class containing a rather small number of members. If we follow the general practice of forming the passive by interchanging the subject and the direct object and expanding the verb appropriately, we discover that the two indirect object constructions have the following passives:

9(b): I gave the ball to John. --> The ball was given by me
to John.

I bought the ball for John. --> The ball was bought by me
for John.

But if we begin with the alternative form of these sentences:

9(c): I gave John the ball.
I bought John the ball.

Then the first sentence has two passives:

9(d): John was given the ball (by me).
The ball was given John (by me).

but the indirect object in for has no passives:

9(e): *John was bought the ball (by me).
*The ball was bought John (by me).

The generative grammarian must cope with the problems presented by the various acceptable and unacceptable sentences presented above by writing the rules of the grammar in such a way that only the sentences, not the non-sentences, are produced. In the case of the indirect object constructions this can be accomplished by permitting the phrase structure grammar to produce only I gave the ball to John and I bought the ball for John. The indirect object rules that transform I gave the ball to John and I bought the ball for John into I gave John the ball and I bought John the ball are arranged so that the passive transformation may be applied to I gave John the ball but not to I bought John the ball. The procedure for applying the rules may be illustrated by constructing an imaginary machine that not only produces the terminal strings that contain the grammatical elements of kernel sentences but also transforms these terminal

strings into all of the grammatical passive forms and none of the un-grammatical forms. In this machine sentence formation begins at the top with the phrase structure rules which produce the terminal strings of kernel sentences and ends at the bottom where only grammatical sentences of English appear as the final product. The transformational rules may be optionally applied to any appropriate terminal string, though they may be applied only once and only to strings that come from above. In the illustration below A has just produced the two strings (1) and (2).

A. Phrase structure rules

(1) The boy past give to John the book

(The boy gave the book to John.)

(2) The boy past buy the book for John

(The boy bought the book for John.)

B. Indirect object transformation #1 (applies only to V_{tiot}'s followed by to)

C. Passive transformation #1 (applies only to V_{tr}'s)

$$\frac{\text{Nom}}{1} + \frac{\text{Aux}}{2} + \frac{V_{tr}}{3} + \frac{\text{Nom}'}{4} + \frac{Y}{5}$$

Structural Change: 4 + 2 + be-en + 3 + 5 + (by + 1)

(In this rule en is the sign of the past participle and Aux refers to any auxiliary element.)

D. Passive Transformation #2 (applies only to V_{tiot}'s)

$$\frac{\text{Nom}}{1} + \frac{\text{Aux}}{2} + \frac{V_{tiot}}{3} + \frac{\text{Nom}'}{4} + \frac{Y}{5}$$

Structural change: 4 + 2 + be-en + 3 + 5 + (by + 1)

E. Indirect object transformation #2 (applies only to V_{tiof}'s)

Apply B to (1): (3) The boy past give John the book

(The boy gave John the book.)

Apply C to (3): (4) $\begin{array}{ccccccc} & \text{Nom'} & \text{Aux} & & V_{tr} & & \text{Nom} \\ \text{The} & \text{book} & \text{past} & \text{be} & \text{en} & \text{give} & \text{John} & (\text{by } \text{the boy}) \\ 4 & & 2 & & & 3 & & 1 \end{array}$

(The book was given John (by the boy).)

$\begin{array}{ccccccc} \text{Nom'} & \text{Aux} & & V_{tiot} & & \text{Nom} & Y \\ & & & & & & \end{array}$

Apply D to (3): (5) $\begin{array}{ccccccc} \text{John} & \text{past} & \text{be} & \text{en} & \text{give} & \text{the book} & \text{by the boy} \\ 4 & 2 & & & 3 & 4 & 5 \end{array}$

(John was given the book (by the boy).)

Apply C to (1): (6) $\begin{array}{ccccccc} & \text{Nom'} & \text{Aux} & & V_{tr} & & \text{Nom} \\ \text{The} & \text{book} & \text{past} & \text{be} & \text{en} & \text{give to} & \text{John} & (\text{by } \text{the boy}). \\ 4 & & 2 & & & 3 & & \end{array}$

(The book was given to John (by the boy).)

Apply C to (2): (7) $\begin{array}{ccccccc} & \text{Nom'} & \text{Aux} & & V_{tiof} & & \text{Nom} & Y \\ \text{The} & \text{book} & \text{past} & \text{be} & \text{en} & \text{buy} & (\text{by } \text{the boy}) & \text{for John} \\ 4 & & 2 & & & 3 & 1 & 5 \end{array}$

(The book was bought (by the boy) for John.)

Apply E to (2): (8) The boy past buy John the book

(The boy bought John the book.)

The sentence producing machine has been constructed in such a way that only the grammatically acceptable passive forms can be produced. The unacceptable passive forms for V_{tiof}'s cannot be generated because the passive transformation cannot be applied to terminal strings that follow it.

Rule (10), then is as follows:

$$V_A + \text{Mot} \longrightarrow \left\{ \begin{array}{l} V_{A'} + \text{Mot}' \\ V_{tiot} + \text{to} + \text{Nom} \end{array} \right\}$$

It will be noticed that just as V_{tiot} + to + Nom is derived from

V_{tr}, so is V_A + Mot'. Consequently, the passive form of V_A + Mot' will be as follows:

10(a): The boy₁ past₂ drive into the garage₃ the car.₄ ----

The car₄ past₂ be-en drive into the garage₃ (by the boy).₁

(The car was driven into the garage (by the boy).)

The same rule that transforms I gave - to John - the ball to I gave the ball to John will change The boy drove - into the garage - the car to The boy drove the car into the garage.

V_{tn} in Rule (9) will be further expanded in a later rule into a number of subclasses which include verbs that choose animate subjects, V_{t1}, animate objects, V_{t2}; animate subjects and animate objects, V_{t3}; and finally a class of verbs that may have objects that are nominalized forms of other simple kernel sentences, V_{t4}.

Now that the classification of verbs described by this version of the phrase structure grammar has been completed (with the exception of V_{tn}, which will be discussed more fully in Rule (29)), it might be helpful to present the classes and sub-classes in the form of a flow chart with V_b as the matrix term. Figure 1 illustrates this.

According to Figure 1, then, it can be seen that a V_A + Mot' is a member of the class V_A + Mot which is a member of the class V_t which is a member of the class V_{tr}. Each sub-class clearly has characteristics that distinguish it from other sub-classes of the same class, yet all sub-classes share certain characteristics that identify them as members of the same class. For example, V_A + Mot' and V_{tiot} + to + Mot both participate in the passive transformation as members of the V_{tr} class, though

V_A' + Mot' may be distinguished from the V_{tiot} + to + Nom because it does not have two passives. Or again: both V_x + P and V_T + C are V_{tr}'s and produce passives in the following way:

The boy past look at the girl

(The boy looked at the girl)

The girl past be-en look at by the boy

(The girl was looked at by the boy)

The boy past call a fool the girl

(The boy called - a fool - the girl)

The girl past be-en call a fool by the girl

(The girl was called a fool by the boy)

Rules (11) - (15) expand the term Adv into a set of terms that account for the simple adverbial constructions, and an undeveloped symbol (ϕ) which will provide for the formation of complex S's containing causative adverbial clauses.

$$(11) \text{ Adv} \longrightarrow \left\{ \begin{array}{l} \text{for + Nom} \\ \text{Loc} \\ \text{Tm} \\ \text{Man} \\ \text{Mot} \\ \phi \end{array} \right\}$$

$$(12) \text{ Loc} \longrightarrow \left\{ \begin{array}{l} \text{P}_L + \text{Nom} \\ \text{Adv}_L \end{array} \right\}$$

$$(13) \text{ Tm} \longrightarrow \left\{ \begin{array}{l} \text{P}_T + \text{Nom} \\ \text{Adv}_T \end{array} \right\}$$

$$\begin{array}{lcl}
 (14) \text{ Mot} & \text{-----}\rightarrow & \left\{ \begin{array}{l} P_{\text{Mot}} + \text{Nom} \\ \text{Adv Mot} \end{array} \right\} \\
 (15) \text{ Man} & \text{-----}\rightarrow & \left\{ \begin{array}{l} P_{\text{Man}} + \text{Nom} \\ \text{Adj} + \text{ly} \end{array} \right\}
 \end{array}$$

43.

These rules will provide for sentences of the following kinds:

- 11(a): I am carrying the books for Mary.
John drinks carrot juice for his health.
- 11(b): I am carrying the books because I like Mary.
John drinks carrot juice because he likes it.
- 12(a): John sat on the house.
The boy stood on the rug.
- 12(b): John lives here.
The boy stood there.
- 13(a): The boy will leave in the morning.
The work must be done before Tuesday.
- 13(b): Class will begin now.
George will come tomorrow.
- 14(a): John ran across the yard.
The boy came into the courtyard.
- 15(a): You must play the game according to the rules.
She danced with aplomb.
- 15(b): John ran away quick+ly.
The girl danced magnificent+ly.

An examination of the first fifteen rules will show that this version of the phrase structure grammar automatically limits the number of adverbial constructions that can appear in a kernel sentence. A sample derivation in which all the possible obligatory and optional adverbial elements are selected will illustrate this. When an optional element is selected, the parentheses will be dropped. When an optional element is not selected, it will not appear in the derivation.

1. S
2. Nom + VP + Adv (by Rule (1))
3. Nom + aux + MV + Adv (2)
4. Nom + aux + V_b + Adv (3)
5. Nom + aux + V + Adv (4)
6. Nom + aux + V_{tr} + Nom + Man + Adv (5)
7. Nom + aux + V_t + Nom + Man + Adv (6)
8. Nom + aux + V_b + prt + mot + Nom + Man + Adv (9)
9. Nom + aux + V_b + prt + mot + Nom + Man + for + Nom (11)

The completed phrase structure grammar would produce from the string in step 9 the following pre-sentence:

The boy + should + bring+up + from the basement + the wine + carefully +
for + his + mother.

the elements of which would be re-ordered to produce the following sentence:

The boy should bring up the wine carefully from the basement for his mother.

In this version of the phrase structure grammar, sentences which contain more than the permissible number of simple adverbial constructions would have to be thought of as complex sentences, with the extra adverbial elements coming in by way of transformation.

Rules (16) - (28) develop the Nom. Here again the procedure involves sub-classification (see figure 2). Rule (16) expands the Nom into a noun phrase and N⁰, a symbol for number that will later be expanded into singular and plural. Many choices in the production of a sentence require the speaker to be conscious of rules of concord. If the subject Nom is singular and the tense is present, then the verb selects an s (The boy + pl + pres + sing ---->The boy sings). If the subject Nom is plural and tense

is present the Nom selects an s but the verb does not (The boy + pl + pres + sing ----> The boys sing). There are also number restrictions; for example, rule (27) describes the restriction on number when the Nom contains a mass noun. It would also be possible (though this version of the grammar does not do it) to indicate the selection of the same number in the predicate as in the subject when the verb is Be, Become, Stay, or Remain.

(16) Nom ----> NP + N°

Rule (17) expands NP into an optional determiner (a, the, his, her, this, that, these, those . . .) an optional C, which provides a slot for dependent clauses and the adjectives that have their origin in dependent clauses, and a noun, N. The C in Rule (17) is not unlike the C in Rule (8) which also provides for complex structures that are a product of more than one kernel sentence. A complete set of phrase structure rules would describe the conditions under which determiners are selected and whether they are optional or obligatory. The following sentences will illustrate the complexity of conditions for determiner selection:

The boy reads well.

*A boy reads well.

*You will never find the more interesting book than The Trial.

These boys can read well.

*Bill bought the bigger house than Jim bought.

*John danced with a prettiest girl in the room.

*I'm afraid a milk is sour.

*He was shot through a heart.

*He gives me the pain in a neck.

It seems clear that a simplified version of a grammar need not attend to the subtle complexities governing selection of determiners -- especially if the grammar is being designed for possible use with junior high or high school pupils. If a generative grammar of English were being developed

for a class learning English as a second language, then determiner selection would be of crucial importance.

$$(17) \text{ NP } \text{-----} \rightarrow (\text{D}) + \text{N} + (\text{C})$$

Nouns are first of all divided into common and proper:

$$(18) \text{ N } \text{-----} \rightarrow \left\{ \begin{array}{c} \text{N}_{\text{pr}} \\ \text{N}_{\text{com}} \end{array} \right\}$$

Proper nouns are either animate or inanimate:

$$(19) \text{ N}_{\text{pr}} \text{-----} \rightarrow \left\{ \begin{array}{c} \text{N}_{\text{pa}} \\ \text{N}_{\text{pi}} \end{array} \right\}$$

Rule (19) will make it possible to show that $\text{John} \overset{\text{N}_{\text{pa}}}{\text{plays}} \overset{\text{V}_{\text{tl}}}{\text{golf}}$ is a kernel sentence in which the animate noun (John) is selected by the V_{tl} (a class of verbs that select animate nouns as subject) and that the deviant sentence Golf plays John is not a kernel sentence, but a sentence that has been transformed in some way. The reason for making this distinction (and for calling it a grammatical distinction) is that the deviant sentence Golf plays John can only be understood in terms of the non-deviant sentence John plays golf. The deviant sentence means that John plays so much golf that it is no longer sensible to think of John as a free agent in this matter. The distinction between deviant and non-deviant sentences leads immediately into the discussion of metaphor: personification is a deviant structure in which a verb which customarily selects an animate noun selects an inanimate noun: The brook laughed. An inanimate noun, brook, is in the position of an inanimate noun, and is consequently personified. Another illustration of a deviant structure is Dylan Thomas's

a grief ago which must be understood in terms of the non-deviant structure a year ago (i.e., $a + N_{Tm} + \text{ago}$). Grief, which is an abstract noun, appears in the position customarily occupied by a time noun. Rule (20) expands animate proper nouns into masculine and feminine:

$$(20) \quad N_{pa} \dashrightarrow \begin{Bmatrix} N_{pm} \\ N_{pf} \end{Bmatrix}$$

Rule (21) expands N_{com} into N_s (noun substitutes) and N_c , a complex symbol that is expanded into concrete noun and abstract noun in Rule (23). Noun substitutes may be either masculine, feminine, or neither one (Rule (22)).

$$(21) \quad N_{com} \dashrightarrow \begin{Bmatrix} N_s \\ N_c \end{Bmatrix}$$

$$(22) \quad N_s \dashrightarrow \begin{Bmatrix} N_{sm} \\ N_{sf} \\ N_{sn} \end{Bmatrix}$$

$$(23) \quad N_c \dashrightarrow \begin{Bmatrix} N_{con} \\ N_{ab} \end{Bmatrix}$$

Concrete nouns are either countable or uncountable (mass):

$$(24) \quad N_{con} \dashrightarrow \begin{Bmatrix} N_{cnt} \\ N_m \end{Bmatrix}$$

Countable nouns are either animate (boy) or inanimate (tree):

$$(25) \quad N_{cnt} \dashrightarrow \left\{ \begin{array}{c} N_{an} \\ N_{in} \end{array} \right\}$$

Animate nouns are masculine (boy), feminine (girl), or neither (student):

$$(26) \quad N_{an} \dashrightarrow \left\{ \begin{array}{c} N_{am} \\ N_{af} \\ N_{an} \end{array} \right\}$$

Mass nouns are not countable, so the grammar provides a rule which defines this restriction:

$$(27) \quad N_m \dashrightarrow N_m + sg$$

Rule (27) states that, when mass nouns are chosen, singular number is selected. In all other cases N^0 is either singular or plural.

$$(28) \quad N \dashrightarrow \left\{ \begin{array}{c} Sg \\ Pl \end{array} \right\}$$

In accordance with some of the distinctions developed in the noun expansion rules, Rule (29) expands V_{tn} into four classes: verbs that select animate nouns as subject (V_{t1} - laugh, astonish), verbs that select animate nouns as object (V_{t2} - astonish, surprise), verbs that select animate subjects and inanimate objects (V_{t3} - alter, complete), and verbs which may have nominalized sentences as objects (V_{t4} - know, believe, understand).

$$(29) \quad V_{tn} \dashrightarrow \left\{ \begin{array}{c} V_{t1} \\ V_{t2} \\ V_{t3} \\ V_{t4} \end{array} \right\}$$

In Rule (30), Prev, which appears originally as an optional symbol in Rule (1), is expanded into E, an emphasis morpheme that produces by transformation such sentences as he DID go, which contrasts with he went; not for negative sentences, and pvb, which is either positive or negative (hardly, scarcely, always, sometimes . . .)

(30) Prev ---> (E) (Mot) (Pvb)

When not and pvb appear together, the Pvb must always be positive:

(31) not + Pvb ---> not + Pos

Otherwise Pvb may be either negative or positive:

(32) Pvb ---> $\begin{cases} \text{Pos} \\ \text{Neg} \end{cases}$

The auxiliary structure in English is varied and complicated. A surprisingly great portion of it is described in Rule (33):

(33) Aux -----> tns $\begin{cases} M \\ \text{be + to} \end{cases}$ (have + En) (be + ing)

Rule (34) accounts for an exception in which tense must be past (there is no *The boy is to have gone); otherwise tense may be either present or past. This description is contrary to the customary description borrowed from Latin which clearly has six tenses (vocat, vocabat, vocabit, vocavit, vocaverat, vocaverit). In Latin there is a clear connection between tense (a grammatical concept) and time (a semantic concept). In English, however, this is not true. Verbs customarily have two or three principal parts (go, went, gone; walk, walked; be, was, been), the first of which is the base form which is used with plural nouns in the so-called present tense, with the sign of the infinitive to, with the modal auxiliaries (can, will,

shall, would, could . . .), and with the sign of the present participle - ing; the second principal part is the past form; the third principal part (sometimes the same as the second) is the past participle and is used when have is an auxiliary. Future time is referred to in English in a variety of ways:

I go to school next summer.
I am going to the game tomorrow.
I will go if you want me to.

There is no future tense in English. Attempts to provide paradigms of English verbs modeled after Latin paradigms will not stand up under close scrutiny. It is now customary to say that English has two tenses, present and past. Some grammarians prefer to say that English contains a past and a non-past tense. There is clearly a grammatical form that can be called past, though there is not clearly a form that can be called present, since the present and the base form are identical unless the subject is singular, in which case an 's' is added to the verb. In this version of the grammar, tense is either present or past:

(31) Tns - be + to - have+En -----> Past - be+to - have+En

(32) Tns $\dashrightarrow$ $\left\{ \begin{array}{l} \text{pres} \\ \text{past} \end{array} \right\}$

The use of the hyphen (-) as a concatenation symbol has no other significance than to call attention to certain elements in a rule. In (31), for example, it is the inseparable be+to auxiliary that selects past only in the context of have+En.

The auxiliary rule describes twenty different auxiliary constructions. Tns is obligatory; all other elements are optional. The following

constructions are illustrative:

(30) a: The boy pres+sing well. (The boy sings well.)

The boy pres+be+to sing well. (The boy is to sing well.)

The boy pres+have+en sing well. (The boy has sung well.)

The boy pres+be+ing sing well. (The boy is singing well.)

The boy pres+have+en+be+ing sing well. (The boy has been singing well.)

The boy pres+M sing well. (The boy will sing well.)

The adj that appears in Rule (4) may be expanded as follows:

(33) Adj -----> (I)A

The optional I provides for intensifiers (very, quite, extremely, too ...),

(34) A -----> $\left\{ \begin{array}{c} A_{at} \\ A_p \end{array} \right\}$

Adjectives may be sub-divided into those that may enter the Nm by

transformation, A_{at}, and those that must remain in the predicate, A_p.

Adjectives must follow certain rules of co-occurrence, so we distinguish

a number of sub-classes which are selected by corresponding classes of nouns.

(35) A_{at} -----> $\left\{ \begin{array}{c} A_{cnt} \\ A_m \end{array} \right\}$

(36) A_{cnt} ----> $\left\{ \begin{array}{c} A_{an} \\ A_{in} \end{array} \right\}$

Adjectives selected by animate and inanimate nouns may frequently have

complement constructions:

$$(37) A_{an} \dashrightarrow \left\{ \begin{array}{l} A_x + C \\ A_y \\ A_z \end{array} \right\}$$

$$(38) A_{in} \dashrightarrow \left\{ \begin{array}{l} A_x + C \\ A_y \\ A_d \end{array} \right\}$$

Rules (37) and (38) provide for the production of such complex sentences as the following:

37(a): The boy is afraid to go.
George is ashamed of his work.
The girl is happy that George is coming.
My friends were sorry about leaving.

38(a): The tree is certain to die.
The seeds are sure to grow.
The fields are ready for plowing.

Predicate adjectives may be sub-divided into animate and inanimate:

$$(39) A_p \dashrightarrow \left\{ \begin{array}{l} A_{pa} \\ A_{pi} \end{array} \right\}$$

thus providing for

39(a): The boy was afraid.
The door is ajar.

It is certainly clear that many rules would have to be added to this version of the phrase structure grammar before it could become an

automatic sentence-generating machine. Such a grammar should include precisely formulated rules that would prevent the generation of such non-sentences as the following:

- *A boy is the man.
- *The boys became a man.
- *John cut herself.
- *Boy hit the ball.

The rules of this version of the grammar suggest that there are certain restrictions that govern the production of well-formed sentences, but many of these restrictions are not stated precisely. A more complete version of the grammar would provide an explicit description of these restrictions. This point can be illustrated by producing a representation (a tree) of the ordered application of the rules (Figure 3).

A tree is formed by applying the rules in order. When all elements in a rule are obligatory (Nom $\rightarrow$ NP + N°) they must appear. When an element is optional (S $\rightarrow$ Nom + VP (Adv)) it may be included in the tree, but if it is not chosen it remains in parentheses and is not developed. In Figure 3, for example, (D), (C), (prev), and (Adv) all remain in parentheses and are not developed. Rule (18) selects a proper noun which automatically rules out the selection of a determiner (*The George). Since the MV becomes Be + Nom, the N° automatically is the same on both sides of the copula (There is no *The boys is a man). Since the N_{pr} is an N_{pa} (animate proper noun), the N following Be must also be animate. Since the N_{pa} is an N_{pm}, the N_{an} following the Be must also be masculine: The grammar does not permit *George is a waitress as a non-deviant utterance, though we would recognize it as a deviant structure comparable to such deviant utterances as Golf plays John and a grief ago. All of these restrictions are only suggested in this version of the grammar.

Figures 4-7 illustrate in somewhat simplified form a variety of terminal strings in tree form. The sentences that would be produced by applying appropriate transformational rules to the terminal strings are included in parentheses at the bottom of each tree.

Figure 1

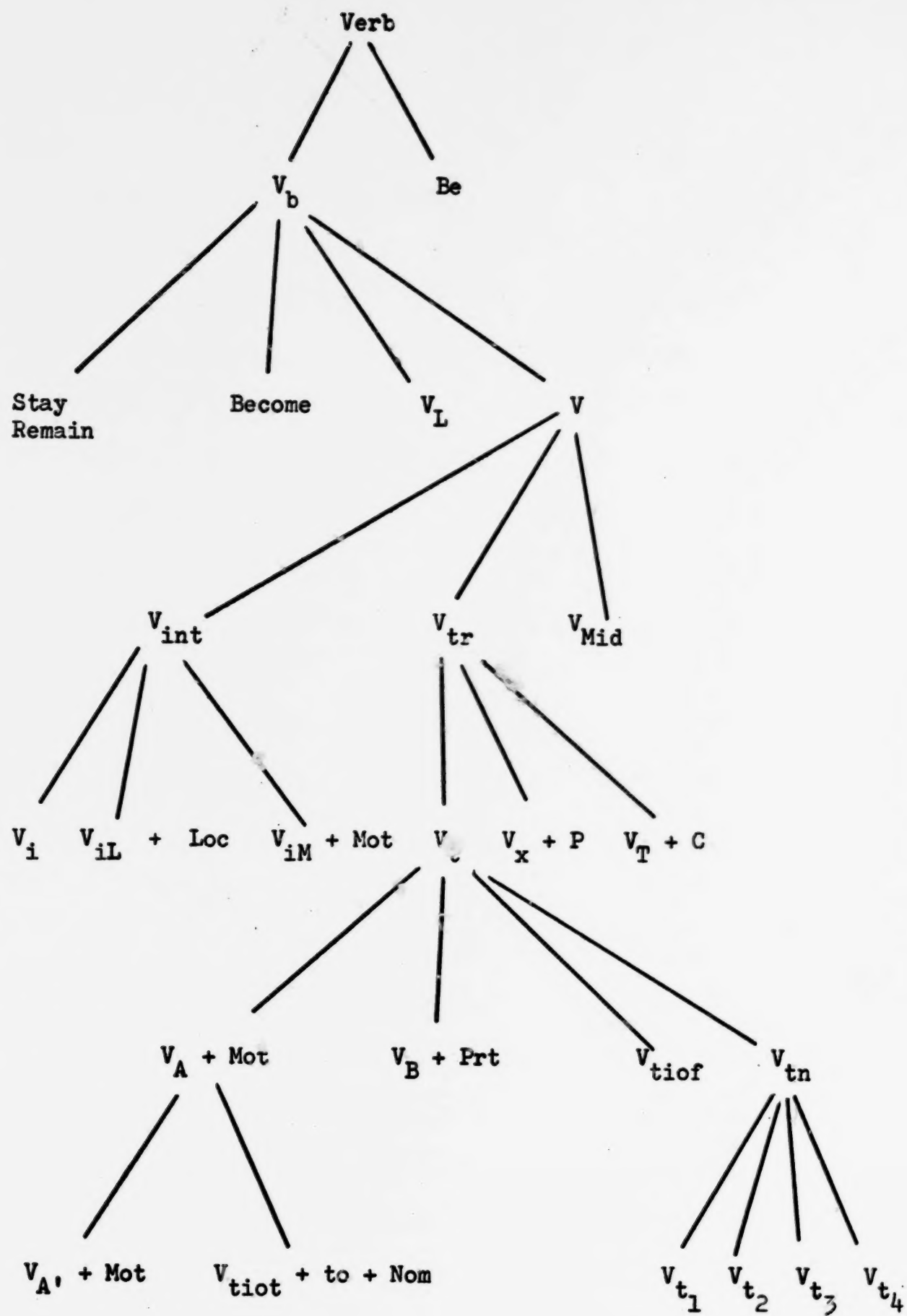


Figure 2

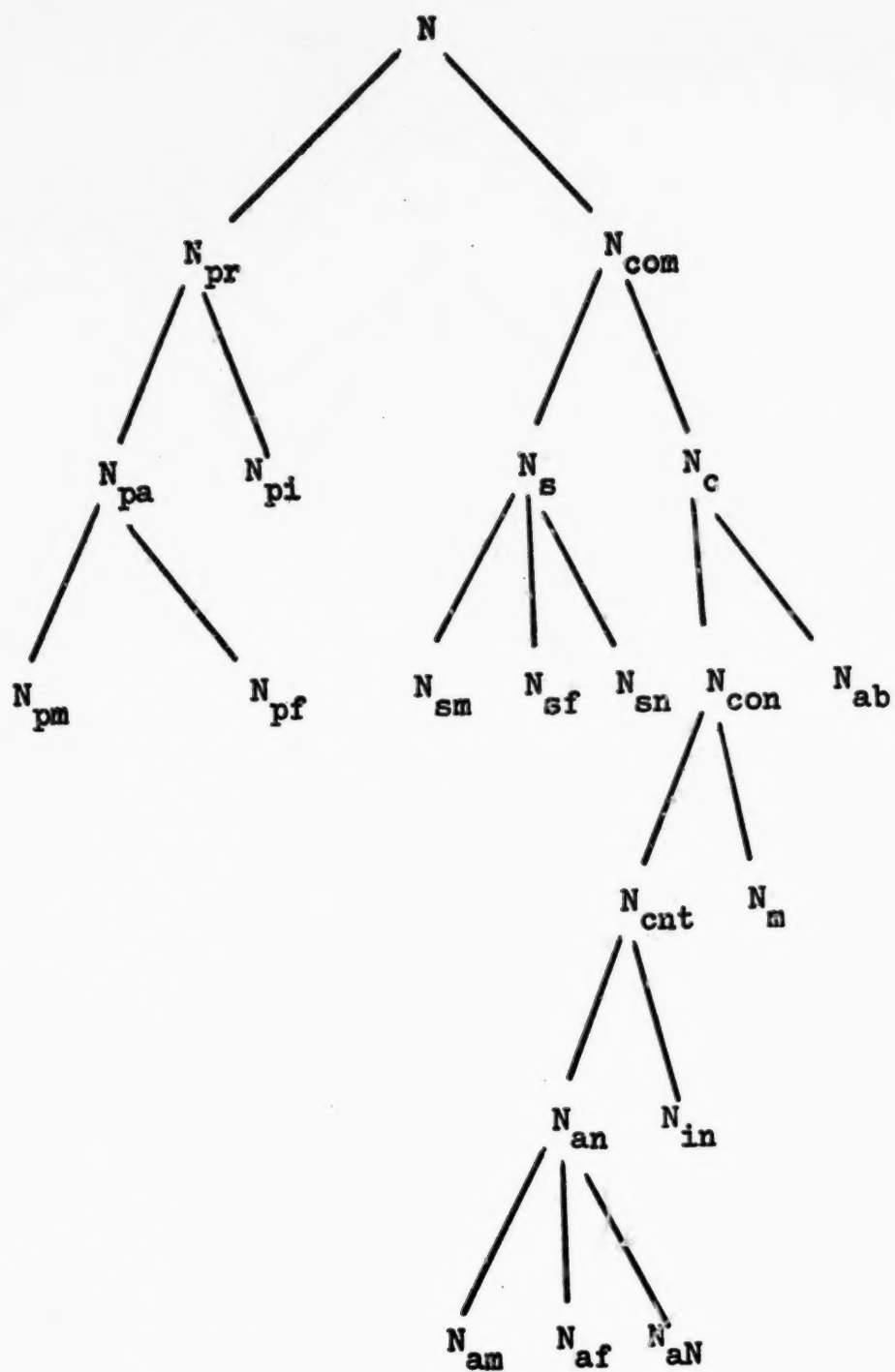


Figure 3

57.

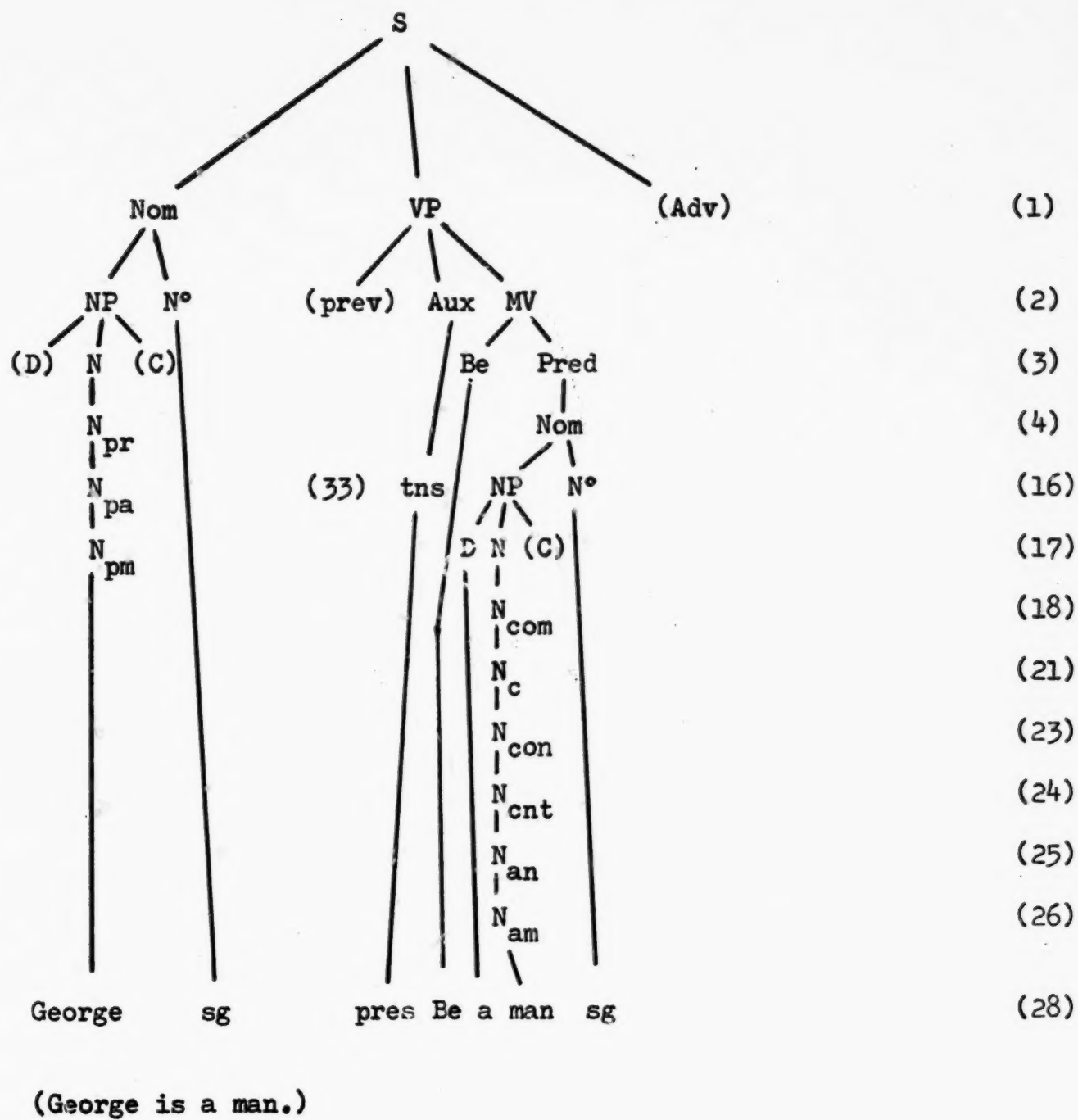
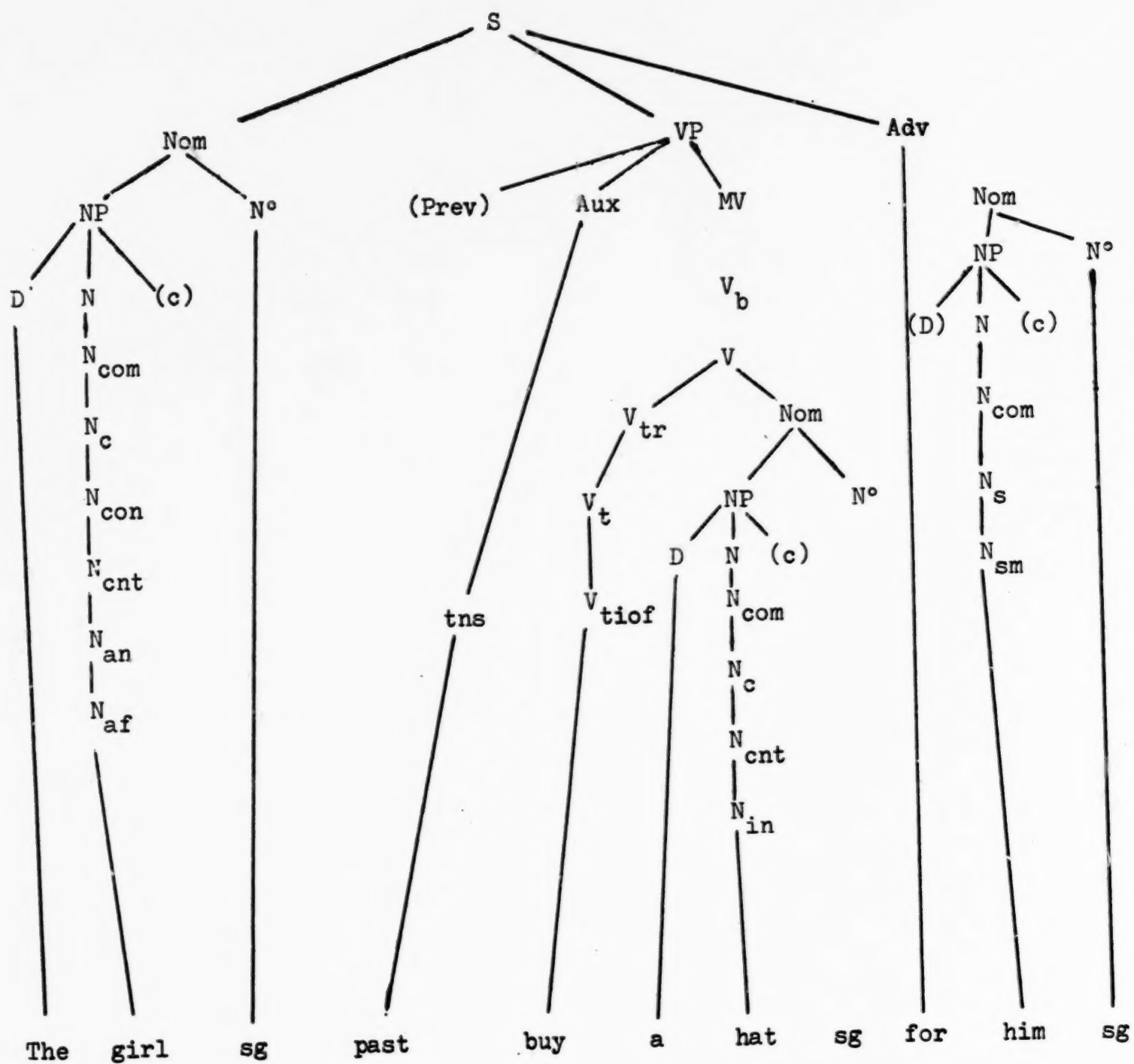
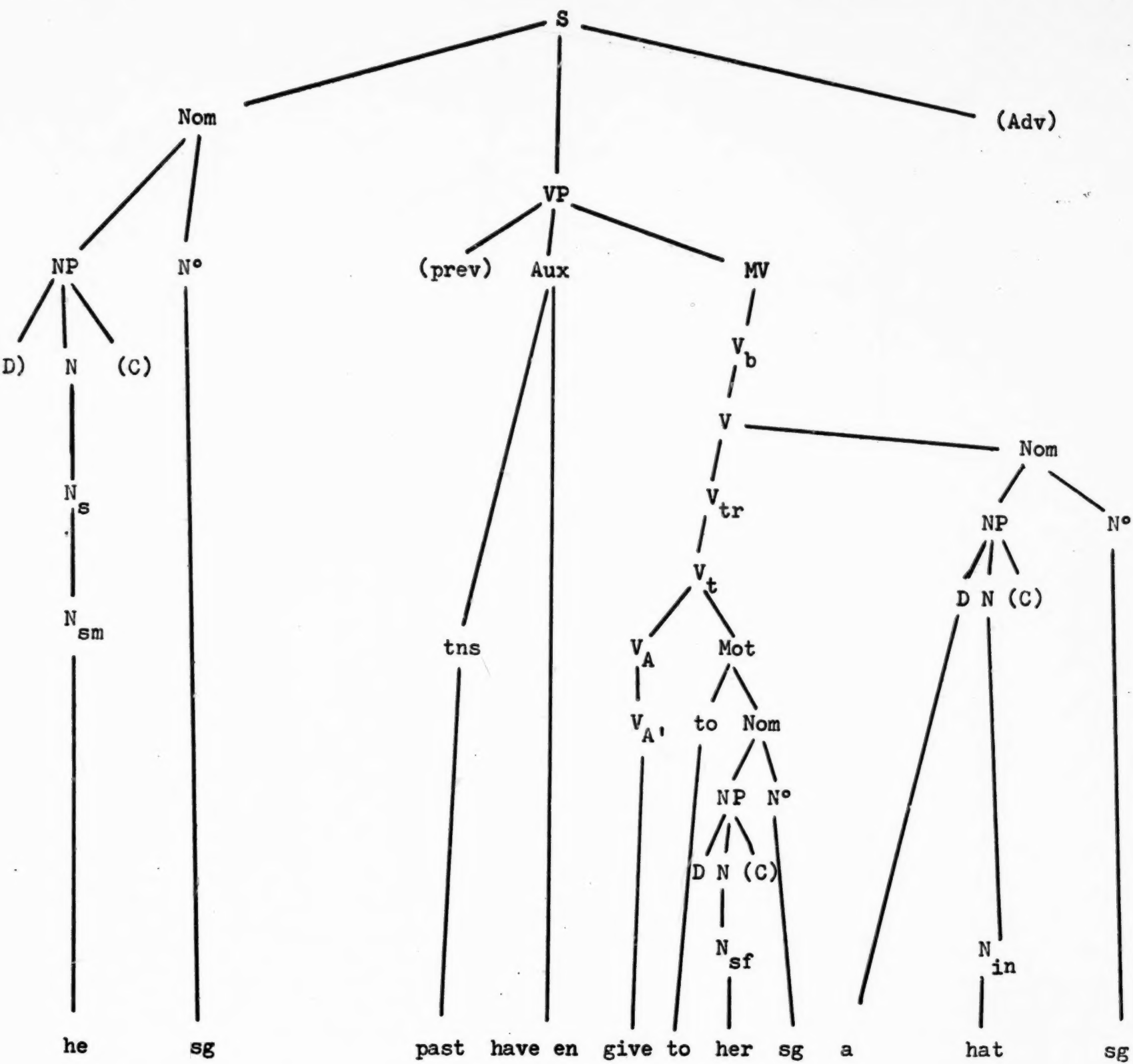


Figure 4

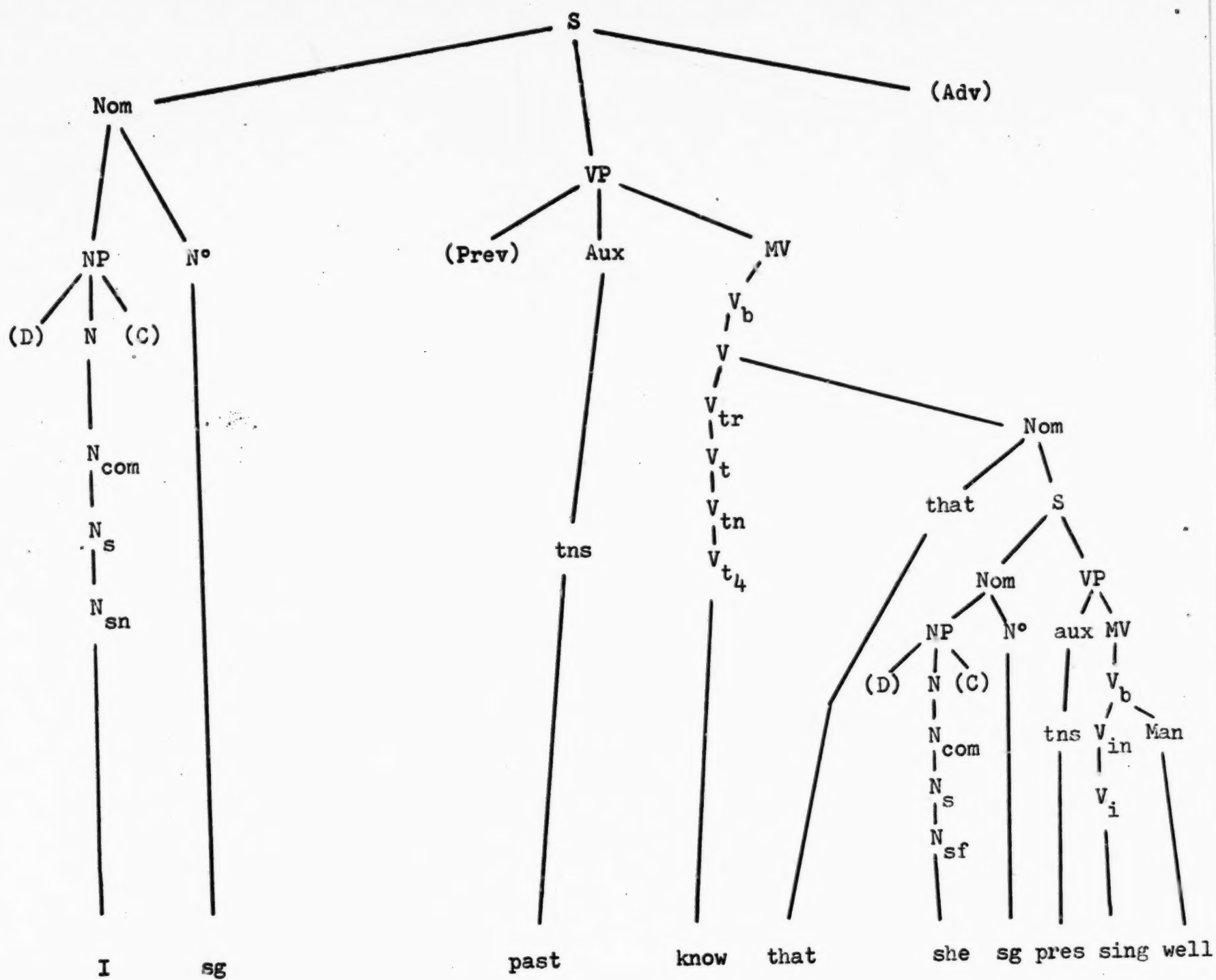


(The girl bought a hat for him.)



(He had given a hat to her.)

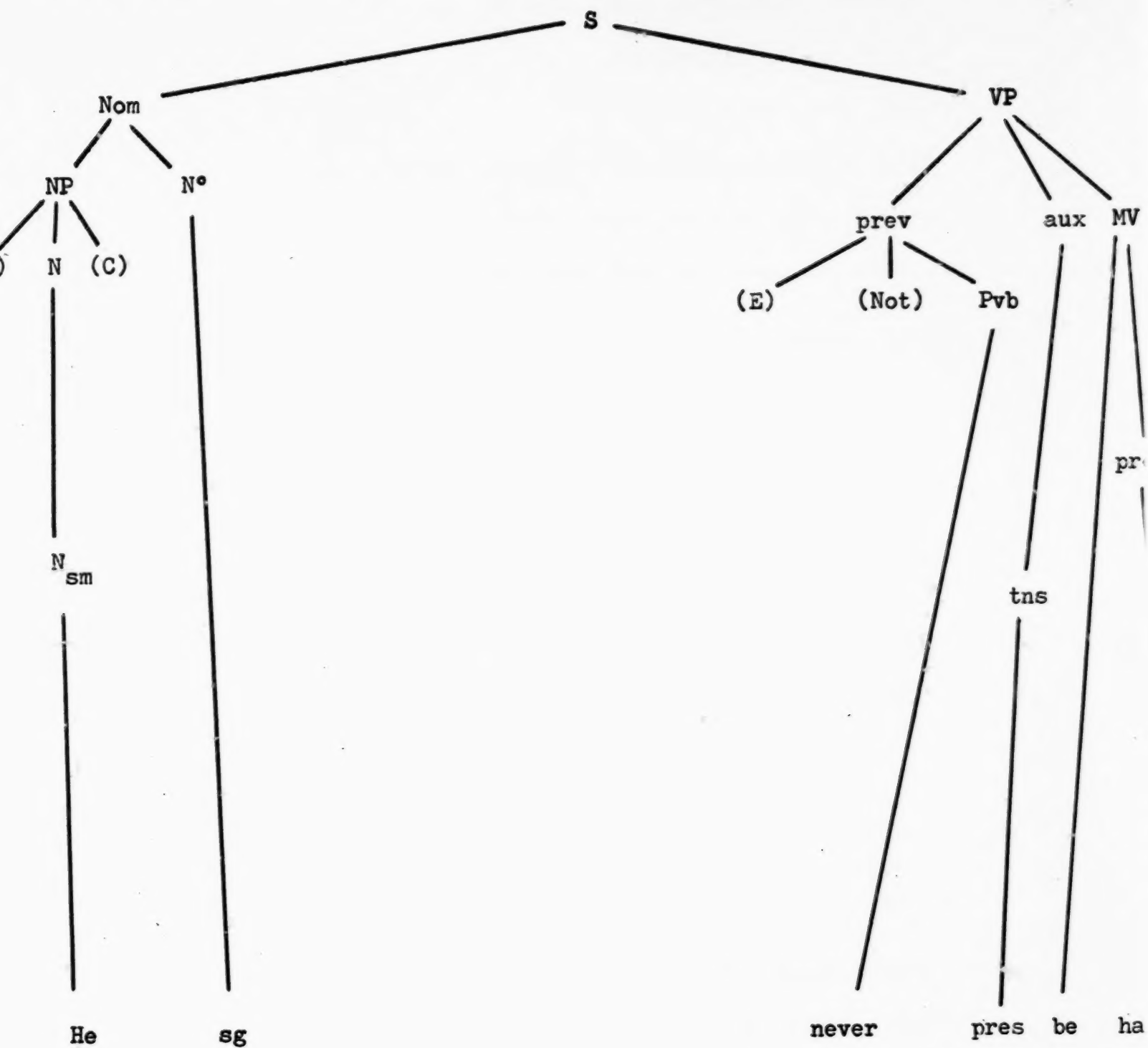
Figure 6



(I knew that she sings well.)

Figure 7

61.



(He never is happy.)

LEXICON

A _d	long, short, tall, old, ...
A _m	abundant, plentiful, rare, scarce, ...
A _{pa}	afraid, nice, happy, sad, ...
A _{pi}	ajar, open, shut, ...
A _x	glad, certain, sure, ready, happy, afraid, ...
A _y	apt, liable, certain, sure, ready, ...
A _z	clever, cunning, foolish, shy, smart, wise, ...
ADV _{MOT}	here, there, ...
ADV _{LOC}	here, there, ...
ADV _{Tm}	yesterday, today, tomorrow, now, then, ...
D	a, an, each, one, some, the, this, that, these, those, ...
I	very, quite, rather, too, ... - - -
M	can, could, may, might, must, shall, should, will, would
N _{ab}	assumption, cause, fact, it, idea, notion, plan, problem, reason, ...
N _{aF}	girl, woman, waitress, hostess, less, lady, ...
N _{aM}	boy, man, waiter, host, lad, gentlemen, ...
N _{aN}	student, teacher, worker, ...
N _{in}	tree, table, chair, desk, pencil, ...
N _m	blood, magic, radium, rice, smoke, ...
N _{sF}	she, her, I, me, us, you, they, them
N _{sM}	he, him, I, me, we, us, you, they, them
N _{sN}	it, they, them
Neg	hardly, never, scarcely, seldom, ...
Nom _{Tm}	June, Monday, 1964, ...
N _{pm}	John, Mr. Smith, ...

N _{pf}	Mary, Mrs. Smith, Miss Jones, ...
N _{pm}	Pennsylvania, Ohio, Germany, New York City, Empire State Building, ...
Prep	after, at, before, by, during, for, in, near, on, of, over, to, ...
Prep _{Loc}	at, in, on, ...
Prep _{Man}	by, with, by means of, along with, ...
Prep _{Mot}	into, onto, to, ...
Prep _{Tm}	on, before, by, after, during, ...
Pos	almost, always, often, probably, sometimes, ...
Prt	across, away, down, in, out, over, under, up, ...
V _A	aim (at), drive (into), put (onto), throw (toward), ...
V _{act}	get, grow, turn, ...
V _{ap}	appear, look, seem, sound, ...
V _B	bring (up), put (away), take (over), put (through), run (up), ...
V _i	arrive, bark, behave, perish, shiver, sleep, swim, vanish, ...
V _{il}	lie, stand, ...
V _{im}	glance, go, look, run, sneak, ...
V _{mid}	befall, cost, have, lack, mean, resemble, weigh, ...
V _s	feel, smell, taste, ...
V _{t1}	acknowledge, admire, bribe, find, praise, thank, ...
V _{t2}	astonish, please, surprise, terrify, ...
V _{t31}	alter, complete, generate, strike, tune, ...
V _{t32}	breathe, eat, hammer, read, sew, smoke, steal, write, ...
V _{t411}	announce, believe, deduce, discover, forget, guess, imply, infer, imagine, know, ...
V _{t412}	demonstrate, mean, prove, show, signify, ...
V _{t42}	attest to, complain about, find out about, hear about, learn of, testify to, vouch for, ...

$V_{t_{43}}$	convince, inform, persuade, tell, ...
$V_{t_{44}}$	believe, guess, know, say, suppose, think, ...
V_{tiof}	build, buy, choose, get, leave, make, order, save, spare, ...
V_{tiot}	give, hand, lend, offer, send, show, ...
V_{Ta}	behold, catch, discover, feel, find, hear, keep, leave, notice, observe, overhear, perceive, see, show, smell, watch
V_{Tb}	discourage, dissuade, hinder, prevent, save, step (from); coax, coerce, delude, dupe, exasperate, force, frighten, goad, provoke (into); accuse, acquit, cure, suspect (of)
V_{Tc}	advise, allow, appoint, ask, authorize, beckon, beg, believe, bid, bribe, cause, caution, choose, command, commission, compel, dare, defy, desire, destine, direct, empower, enable, engage, entice, entreat, exhort, expect, get, help, hire, induce, instruct, intend, invite, lead, leave, mean, need, order, commit, persuade, prefer, press, prompt, provoke, request, require, sentence, summon, teach, tell, tempt, trust, urge, want, warn, wish
V_{Td}	consider, declare, judge, know, suppose, suspect; hate, like, love
V_{Te}	bid, feel, have, hear, let, make, notice, overhear, see, watch
V_{Tf}	appoint, crown, nominate; baptize, call, christen, dub, name; consider, declare, esteem, judge, keep, leave, make, presume, proclaim, pronounce, prove, put, report, see, suppose, think, want, wish.
V_{Tg}	color, paint; keep, make, think, suppose, ...
V_{Th}	keep, leave, put, ...
$V_{in(C)}$	begin, cease, commence, continue, finish, give up, go, keep, keep on, practice, start, stop, ...; lie, run, stand, ...
V_x	flirt (with), look (at), object (to), step (on), talk (about), ...

3. AN INFORMAL PRESENTATION OF THE TRANSFORMATIONS OF ENGLISH

The phrase structure grammar developed in Chapter II will provide an introduction to the formal operations that characterize generative grammar. A formal presentation of a complete generative grammar would also include an ordered set of transformational rules that specify the complex sentences of English and an ordered set of phonological rules that show how strings of symbols are transformed into sequences of sounds. Though it seemed necessary to treat the phrase structure rules formally, with the exception of a few illustrative rules needed to clarify parts of the phrase structure grammar, it seemed desirable to present the transformations of English informally. Any attempt to develop an ordered set of phonological rules would be pedagogically irrelevant in a composition course.

The informal presentation of the transformations of English in this chapter is a revision of the material used with the experimental class as well as a description of the device which was used to analyze the prose samples. Though every effort has been made to eliminate inconsistencies and gross errors, there has been no attempt to adapt the tone or manner of expression to the new audience. Exercises have been omitted.

TYPES OF TRANSFORMATIONS

There are four types of transformations in our grammar: 1) Simple, 2) Embedding, 3) Conjoining, and 4) Deleting.

1. Simple Transformations: These are the transformations that are applied only to single-based sentences. Thus a sentence like She watched the baby can be transformed into The baby was watched by her by means of the passive transformation, which is a simple transformation. Among the other simple transformations are those that change a positive statement to a negative one and a statement to a question. In each case the elements of the original sentence are rearranged and sometimes new elements are added.

2. Embedding Transformations: These are the transformations by means of which one kernel sentence is embedded in another; the resulting sentence, of course, must be a complex sentence. Each time the embedding transformation is re-applied, the already complex sentence has one more kernel sentence underlying it. For example, the sentence The small boy who always plays in the yard with the high fence borrowed my new bat yesterday is a complex sentence with its origin in six kernel sentences. This grammar identifies thirty-six different embedding transformations, the employment of which reveals significant information about the competence of the writer. Since the preponderance of transformations to be identified are embedding transformations - 36 out of 46 - this chapter will devote its major treatment to embedding transformations.

3. Conjoining Transformations: These are the transformations that connect single sentences in a variety of ways; the resulting sentence, again, must be a complex sentence. Thus, I saw John and I saw Bill is a complex sentence formed from two kernel sentences: I saw John/ I saw Bill. Many words can be used for conjoining, though the most frequently used are and, but, and or.

4. Deleting Transformations: These are the transformations that enable us to delete certain words from the sentences we have formed. The sentence I saw John and I saw Bill was given above as an example of the use of a conjoining transformation. A deleting transformation can remove the second I saw to produce the complex sentence I saw John and Bill. This sentence is a complex sentence, of course, because its origin still lies in two kernel sentences: I saw John/ I saw Bill.

Transformations are used automatically in sentence production. Some people rely more heavily on one type than on another; or, within one type of transformations, certain transformations are used more frequently than other transformations. With a total of at least forty-six transformations possible in this grammar, it may turn out that we can identify a characteristic way each writer forms his sentences. For example, a second grader may average only two embedding transformations per sentence, whereas a William Faulkner may use as many of thirty per sentence. The individual transformations used, moreover, may also reveal something unique about the individual writer. Here then is another aim of our study: To be able to construct a grammatical profile for various writers, from second grade through twelfth and beyond.

EMBEDDING TRANSFORMATIONS (ET's)

The embedding transformations are used for two main functions:

1) expansion and 2) replacement. Each of the four major parts of speech - N, V, Adj, Adv - may be expanded by means of ET's. Two of the four, the N and the Adv, may also be replaced by ET's. In the phrase structure component of this grammar there were three places where the undeveloped symbol C appeared: in the $V_T + C$, in the expansion of NP into $D + N + C$, and in the expansion of Adj into $A + C$. If we replace these C's with kernel sentences, we would expand the verb, the noun, and the adjective respectively.

Following are some examples of each type of expansion and replacement.

Verb expansion: $Nom + V - C - Nom \rightarrow We\ heard - C - the\ boy$
 $\rightarrow$
The boy was shouting

We heard - shouting - the boy $\rightarrow$ We heard the boy shouting.

In this example heard is a V_T and shouting is a C. This sentence is a complex one because it has its origin in two kernel sentences: We heard - C - the boy/ The boy was shouting.

Noun expansion: $NP + Be + Adj \rightarrow D + N + C + Be + little \rightarrow$

The boy - C - is little
 $\rightarrow$ The boy who is happy is little.
 The boy is happy

In this example the C in the NP has been replaced by an S to which the WH transformation has been applied. This sentence is a complex one originating in the two kernel sentences: The boy is little/ The boy is happy.

Adjective expansion: $He\ is + Adj \rightarrow He\ is\ A + C$

He is eager + C
 $\rightarrow$ He is eager to go.
 He goes

Adverb expansion: In the phrase structure component, Adv is rewritten Man + C. The C is replaced with a that + S. Thus:

He ran + Adv
 He ran + Man + C
 He ran so quickly + C
 He ran so quickly + that + S
 He ran so quickly that his legs ached.

Noun replacement: N is astonishing. Replace N with That + S.
 Result: That he won the election is astonishing.

Adverb replacement: The boy goes + Loc. Replace Loc with Where + S.
 Result: The boy goes where the girls are.

In the phrase structure component, S is rewritten as Nom + V_p + ϕ . The ϕ can be expanded into a because + S, if + S. . .
 Thus:

He visited his mother + ϕ
 Expand ϕ into because + S, She in-
vited him.
 Result: He visited his mother because she invited him.

This preview of the Embedding Transformations indicates their general nature. The next section takes up in some detail the thirty-six ET's that help produce sentences of varying complexity.

EMBEDDING TRANSFORMATIONS

Expanding the Nom

One of the most frequently appearing transformations associated with the Nom is the relative clause, which replaces the C attached to the NP. Any two kernel sentences that have a Nom in common may be combined to form a complex sentence containing a relative clause. That is to say, one kernel sentence is made into a relative clause and then embedded in the other sentence. We call the sentence that is to be embedded the Constituent Sentence and the sentence in which

it is embedded the Matrix Sentence:

- (1) M: The boy has a dog. -----> The boy has a dog which
C: The dog is my friend. is my friend.
- (2) M: The boy is happy. -----> The boy who is little is
C: The boys is little. happy.
- (3) M: I know the boy. -----> I know the boy who works
C: The boys works hard. hard.
- (4) M: I know the boy. -----> I know the boy whom Mary
C: Mary likes the boy. likes.
- (5) M: Mary swims in the lake. -----> Mary swims in the lake
C: Joan swims in the lake. that Joan swims in.

or
Mary swims in the lake
where Joan swims.

To distinguish related but different transformations, it is useful to recognize three kinds of relative clauses. Each of these relative clauses is associated with a different structure. Look closely at the following sets of sentences:

- (6) A) M: I know the boy. ----->
C: The boy is on the window sill.

I know the boy who is on the window sill. -->
I know the boy on the window sill.
- B) M: I know the boy. ----->
C: The boy is tall.

I know the boy who is tall. -->
I know the boy tall. (The "" means "not possible
in English.") ---
I know the tall boy.
- (7) M: The boy is my friend. ----->
C: The boy has red hair.

The boy who has red hair is my friend. -->
The boy with red hair is my friend.
- (8) A) M: A boy is happy. ----->
C: The boy swims.

The boy who swims is happy.

- (8) B) M: A boy is happy.
 C: The boy is swimming. ----->
 A boy who is swimming is happy. -->
 A boy swimming is happy. -->
 A swimming boy is happy.
- C) M: A boy is flirting with death.
 C: The boy is swimming in a river. ----->
 A boy who is swimming in a river is flirting with death. -->
 A boy swimming in a river is flirting with death.
- D) M: A boy is wet.
 C: The boy is swimming. ----->
 A boy who is swimming is wet. -->
 A boy swimming is wet. -->
 A swimming boy is wet.

If you examine the sentences above carefully, you will discover why they are grouped in three sets. The distinguishing feature, of course, is the verb in the relative clause. In (6) the verb is Be; in (7), have; and in (8), all others. You have probably also noticed that the WH + tns + Be may be deleted, leaving acceptable sentences except where an obligatory transformation is needed to rearrange the word order. Relative clauses containing have can be transformed to a with-phrase, as in (7). The reverse is not true, of course: Not all with-phrases come from relative clauses in have.

Compare these two sentences:

- (9) The book with the jacket belongs to Hermione.

Hermione hit the ball with her hand.

Sentence 1 comes from The book which has the jacket belongs to Hermione, though sentence 2 does not come from *Hermione hit the ball which has her hand.

Finally, the sentences in (8) contain relative clauses which may have as their verbs any V_b . When the sux in the relative clause

consists of tns + Be + ing, the WH-word + Tns + Be may be deleted, and the remainder will be an acceptable sentence. For example, the sentence The boy who is running down the street is my friend contains the relative clause who is running down the street; since the aux in this relative clause is pres + Be + ing, the WH-word + pres + Be (in this case, who is) may be deleted, leaving the acceptable English sentence The boy running down the street is my friend. When the deletion of the WH-word + Tns + Be leaves only the single word verb in the ing form, this word may be moved to the position between the determiner and the noun. For example, if who is is deleted from the relative clause who is swimming in the sentence The boy who is swimming is happy, two additional complex sentences may be formed: The boy swimming is happy, or The swimming boy is happy.

We can now list our first six Embedding Transformations (ET):

- ET-1: Relative Clause (Be)
- ET-2: Adjective (by deletion and obligatory placement)
- ET-3: Relative Clause (Have)
- ET-4: With-phrase
- ET-5: Relative Clause (V_p)
- ET-6: Gerundive Adjective (by deletion and optional placement)

We have now accounted for most of the structures that are said to modify the noun. Presumably, the word modify means in grammatical terms expand, though it is frequently said that adjectives, relative clauses, and deleted clauses alter the

meaning of the Nom in some way. It is certainly true that the boy who lives across the street is more definitive than the boy, and it is in this sense that modifiers not only produce more complex grammatical structures but also produce more complex semantical structures.

Before we leave the subject of noun-phrase expansion there are two other structures to consider. When adjectives appear between a D and an N, they may be accounted for in the following way:

- (10) The little boy ----> * the boy little ---->
 The boy who is little

It may seem unnecessarily complicated to construct a grammar in such a way that it takes three operations to get an adjective in the proper position. This may be true, though it should be observed that the same set of rules (from kernel sentences to relative clause to deletion of WH + Tns + Be to obligatory placement of the adjective) also accounts for a number of other structures:

- (11) The boy (who is) on the corner is my friend.
- (12) The boy (who is) standing on the corner is my friend.
- (13) The boy (who is) standing is my friend.
- (14) The boy standing is my friend.
- (15) The standing boy is my friend.
- (16) The boy (who is) single is happy.
- (17) *The boy single is happy.
- (18) The single boy is happy.

You can be sure that a word is an adjective if it will fit in

the sequence in (10) or (16)-(18). A gerundive adjective will fit in the sequence (13)-(15). Any word occurring between a D and an N that will not meet the positional requirements of an adjective or a gerundive adjective must, then, be some other kind of word.

Look for example at the following noun phrases:

- (19) . . . the school teacher --> X teaches school.
- (20) . . . a bull ring --> X fights bulls in a ring.
- (21) . . . a station wagon --> X drives the wagon to
the station.
- (22) . . . the boiling point --> X boils at a point.
- (23) . . . a washing machine --> X is a machine for
washing clothes.
- (24) . . . a night owl --> the owl flies at night.
- (25) . . . a garden party --> X gave a party in the
garden.
- (26) . . . a book review --> X gave a review of the book.
- (27) . . . an eating place --> X is a place in which
eating is done.
- (28) . . . a car thief --> The thief steals the car.
- (29) . . . a fighter plane --> The plane is used to
fight X.
- (30) . . . an artist's model --> the model of an
artist --> The
artist has a model.
- (31) . . . the mountain's top --> the top of the moun-
tain --> the moun-
tain has a top.
- (32) . . . the man's house --> the house of the man -->
the man has a house.

We have shown that each of the above structures has a different origin and has to be derived in accordance with the rules

of the grammar. However, it would make our stylistic analysis too cumbersome to list a separate rule for each of these structures. Consequently, we will consider (19) through (29) as compounds and (30) through (32) as genitives. We will also consider all of-phrases that can be transformed to the genitive as genitives (the top of the mountain-----> the mountain's top).

We can now add transformational rules 7 and 8.

ET-7 - Compounds

ET-8 - Genitive

Replacing the Nom

Sentences can be transformed in a number of ways so that they can replace the Nom of a matrix sentence. For some of these nominalization transformations there are a number of restrictions:

- 1) a nominalized sentence can only replace the subject Nom of the matrix sentence when the verb of the matrix sentence is Be (am, is, are, was, were, has been, have been, had been), V_{link} (appear, look, seem, sound, ...; feel, smell, taste, ...), or V_{t₂} (astonish, please, surprise, terrify, ...);
- 2) a nominalized sentence can only replace a Nom in the VP of the matrix sentence when that verb is a V_{t₄₁} (announce, believe, discover, forget, guess, imagine, know, notice, perceive, recall, reveal, remember, say, see, suggest, understand, ...; demonstrate, mean, prove, show, signify, ...), a V_{t₄₂} (attest to, complain about, find out about, hear about, learn of,

- 2) testify to, vouch for, . . .), or a V_{t43} (convince, inform, persuade, tell, . . .);
- 3) the Nom of a matrix sentence can only be replaced when it contains an N_{ab} (assumption, cause, fact, idea, it, notion, plan, problem, reason, that, thing, trouble, . . .).

Examine the following sentences in which a that + S replaces a Nom (N_{ab}) in the matrix sentence:

- (1) M: N_{ab} + is astonishing. --> That he won the fight is
C: He won the fight. astonishing.
- (2) M: John knew + N_{ab}. --> John knew that he won the fight.
C: He won the fight.
- (3) M: *N_{ab} + is green. --> *That he won the fight is green.
C: He won the fight.

From here on, we will use IT as the N_{ab} in the matrix.

- (4) M: IT is incredible. --> What he knows is incredible.
C: He knows something.
- (5) M: I have forgotten IT. --> I have forgotten what he knows.
C: He knows something.
- (6) M: *IT is rectangular. --> *What he knows is rectangular.
C: He knows something.
- (7) M: IT is a problem. --> Where to go is a problem.
C: I go somewhere.
- (8) M: I know IT. --> I know where to go.
C: I go somewhere.
- (9) M: *IT is green. --> *Where to go is green.
C: I go somewhere.
- (10) M: IT is the question. --> To be or not to be is the question.
C: I am.
C: I am not.
- (11) M: Joy arranged IT. --> Joy arranged to go.
C: Joy went.
- (12) M: *IT is oblong. --> *To be or not to be is oblong.
C: I am.
C: I am not.

- (13) M: IT is exceptional.
 C: He constructs the model rapidly. --> His rapid construction of the model is exceptional.
- (14) M: *IT is purple.
 C: He constructs the model rapidly. --> *His rapid construction of the model is purple.

When we say that only Nom's containing an N_{ab} can be replaced by a nominalized sentence, we are introducing the concept of co-occurrence, which is to say that only certain structures can occur with certain other structures. It is under unusual circumstances that such deviancies as the truth is green could be understood. It is possible that the truth is green has certain metaphorical implications, though it is not the job of a grammar to produce such deviant sentences. We can understand certain deviant structures because we recognize in what way they are deviant. For example, the potential humor connected with Golf plays John is a product of our understanding that Golf plays John is deviant because plays ordinarily must have an animate noun as subject. Your ability to understand the joke in Golf plays John depends on your being able to see the relationship between the deviant sentence Golf plays John and the non-deviant sentence John plays golf. The meaning of the deviant sentence can be understood only in terms of the non-deviant sentence. In general, nominalized sentences can replace only Nom's which contain an N_{ab}; this is a grammatical way of saying that nominalized sentences share certain co-occurrence restrictions with abstract nouns. Consequently, such "sentences" as *That he won the fight is green are not produced by the grammar.

We are ready now to examine the structures in which nominalized sentences have replaced the Nom. If a sentence is a representation of a state of affairs, then it is possible to construct a complex

sentence in which this state of affairs may be treated in the same way as an abstract noun. Look at the following sentences in which IT takes the place of the Nom to be replaced in the matrix sentence:

- (15) IT is true. -----> That + I love you + is true.
I love you.
V_{link}
- (16) IT became certain. ---> That I love you became certain.
I love you.
V_{t2}
- (17) IT astonishes me. --> That I hit the ball astonishes me.
I hit the ball.
V_{th1}
- (18) I know IT. --> I know - that + I love you.
I love you.
V_{th2}
- (19) I complained about IT. --> I complained (about) that
John broke the window. John broke the window.
V_{th3}
- (20) I told her IT. --> I told her that I love you.
I love you.

(15) through (17) illustrate the that-clause as a replacement of the subject Nom. (18) through (20) illustrate replacements of Nom's appearing in the VP. In most cases of that-clauses replacing Nom's appearing in the VP, the introductory word that is optionally deletable after most matrix verbs; however, there is a small group of matrix verbs after which the introductory word that is not deletable:

grieve, rejoice, . . . For example,

I know that you see me. -----> I know you see me.

but no: I rejoice that you see me --> *I rejoice you see me.

We now add rules 9 and 10a and 10b:

ET-9: That + S as subject

ET-10a: (That) S as object

ET-10b: That + S as object

Sentences to which the WH-transformation has been applied may also replace NOM's in the same way.

- (21) M: IT is interesting. --> What he knows is interesting.
 C: He knows something.
- M: IT seems miraculous. --> What he knows seems miraculous.
 C: He knows something.
- M: IT astonishes me. --> What he knows astonishes me.
 C: He knows something.
- (22) M: I understand IT. --> I understand what he knows.
 C: He knows something.
- M: I complained about IT. --> I complained about what he
 C: He knows something. knows. (Notice that the P
is not deletable.)
- M: I told her IT. --> I told her who he was.
 C: He was the president.

If you explore the possible combinations of WH + S and matrix sentences containing V_{t41}, V_{t42}, and V_{t43} + Nom, you will find that there are certain WH + S's that will not work. For example, it is impossible to say *I believe when he went, though I believe that he went is possible. Presumably a fully developed generative grammar would contain rules that would not permit the first sentence to be produced, and, in fact, this is the case with the grammatical set of rules that the native speaker uses to produce any of the infinite number of sentences he is potentially able to utter. For our purposes, however, it is not necessary to construct a complete generative grammar -- even if that were possible -- for our goal is to recognize how sentences that have been produced were produced. As stylistic analysts we must be able to reconstruct the transformational history of each complex sentence we examine. It will not be necessary to reconstruct sets of formalized rules in which all the restrictions are accounted for.

ET-13: WH + (for + Nom) + Infinitive as subject

ET-14: WH + (for + Nom) + Infinitive as object

There are also certain restrictions that seem to apply to the WH + Infinitive constructions that do not apply to That + S or WH + S. In order to become familiar with these constructions, it would be helpful for you to construct as many examples of these constructions as possible, indicating by an asterisk (*) which constructions are non-sentences.

The next rule involves the infinitive in sentences like

This is the man to know. and The date to remember is his birthday.

These sentences seem to be derived from:

(27) This is the man.
I should know the man. --> This is the man for me to know. -->
This is the man to know.

(28) The date is his birthday.
I should remember the date. --> The date for me to remember
is his birthday. --> The date
to remember is his birthday.

It appears that in the constituent sentences the Nom + should + V_b is transformed into for + Nom + Infinitive in much the same way as ET-13 and ET-14 operate. It also seems that, like ET-13 and ET-14, the for + Nom is deletable, though this only seems to occur when the Nom is I or me, or when this Nom is identical to one in the matrix. For example,

(29) This is the man.
You should know the man. --> This is the man for you to know.
but no: *This is the man to know.

(30) The date is his birthday.
You should remember the date. --> The date for you to remember
is his birthday. but no: *The
date to remember is his birthday.

(31) He had a definite call./ He should preach. --> He had a
definite call for him to preach. --> He had a definite
call to preach.

We now add this new rule: ET-15: Nominal Infinitive of Obligation.

Another rule involving the infinitive is illustrated in these sentences: To sing in the chorus is fun, For him to sing in the chorus is fun; To run fast is exciting, For him to run fast is exciting; To write letters is a nuisance, For us to write letters is a nuisance; To play games at a party is great fun, For us to play games at a party is great fun. These sentences seem to be derived as follows:

- (32) IT is fun.
I sing in the chorus. --> For me to sing in the chorus is fun. --> To sing in the chorus is fun.
- (33) IT is fun.
We sing in the chorus. --> For us to sing in the chorus is fun. but no: *To sing in the chorus is fun.
- (34) IT is exciting.
I run fast. --> For me to run fast is exciting. --> To run fast is exciting.
- (35) IT is exciting.
He runs fast. --> For him to run fast is exciting. but no: *To run fast is exciting.
- (36) IT is a nuisance.
I write letters. --> For me to write letters is a nuisance. --> To write letters is a nuisance.
- (37) IT is great fun.
I play games at a party. --> For me to play games at a party is great fun. --> To play games at a party is great fun.
- (38) IT is great fun.
We play games at a party. --> For us to play games at a party is great fun. --> but no: *To play games at a party is great fun.

It seems apparent that the Nom + Vb in the constituent sentence

can be transformed into for + Nom + Infinitive, and if the Nom is I or me, the for + Nom can be deleted, producing a second complex sentence. We now add a new rule to the list:

ET-16: (For + Nom) Infinitive as subject.

Still another rule involving the infinitive is illustrated in these sentences: He forgot to call her, I wanted to meet him, I tried to answer the questions correctly, and I meant to call you last night. These sentences seem to be derived as follows:

- (39) He forgot IT.
He called her. --> He forgot to call her.
- (40) I wanted IT.
I met him. --> I wanted to meet him.
- (41) I tried IT.
I answered the questions correctly. --> I tried to answer the questions correctly.
- (42) I meant IT.
I called you last night. --> I meant to call you last night.

Other verbs which can take the infinitive as object as a replacement for IT in the matrix sentence include: ache, afford, agree, aim, appear, arrange, ask, aspire, attempt, bear, beg, begin, care, chance, choose, claim, combine, commence, condescend, consent, conspire, continue, contrive, dare, decide, decline, design, deserve, destine, endeavor, expect, fail, forget, get, happen, hate, have, hesitate, hope, intend, learn, like, love, manage, mean, need, neglect, offer, prefer, presume, pretend, promise, propose, prove, refuse, remember, seek, seem, serve, start, strive, tend, think, threaten, try, undertake, venture, volunteer, want, and wish.

We now add a new rule to the list of NOM replacement transformations:

ET-17: Infinitive as Object.

There are four additional nominalizations that belong in this group: (1) infinitival of purpose; (2) gerundive nominal; (3) gerundive nominal of purpose; and (4) abstractive nominal.

The infinitival of purpose differs somewhat from the infinitive object of the verbs in the section we have just finished.

Examine the following sentences:

- (43) The boy began + IT. ET-17
The boy hit the ball. --> The boy began to hit the ball.
- (44) The man made the toy for IT. --> *The man made the toy for
The man plays with the toy. to play with. --> The
man made the toy to play
with.
- (45) The dog started + IT. ET-17
The dog ran. --> The dog started to run.
- (46) The lesson is designed for IT. --> *The lesson is designed
The lesson helps you. for to help you. --> The
lesson is designed to help you.
- (47) We wanted IT. ET-17
We came to the party. --> We wanted to come to the party.
- (48) He bought the car for IT. --> *He bought the car for to drive
He drives the car to work. to work. --> He bought the
car to drive to work.

(44), (46), and (48) contain infinitivals of purpose, as can be seen by the phrase for + IT in the matrix sentence of each of these examples. In addition, each of the complex sentences in (44), (46), and (48) may be transformed into questions in WHY or WHAT FOR, where the answers will be the infinitival phrase.

(49) Why did the man make the toy? To play with.

(50) What is the lesson designed for? To help you.

(51) Why did he buy the car? To drive to work.

However, the complex sentences in (39), (41), and (43)-- which contain infinitival complements after the verb--may not be transformed into questions in WHY or WHAT FOR which will produce the infinitival phrase as the answer:

(52) *Why did the boy begin? *To hit the ball.

(53) *Why did the dog start? *To run.

(54) *Why did we want? *To come to the party.

We now add a new rule to our list of NOM replacement transformations:

ET-18: Infinitival of Purpose.

The gerundive nominal is a somewhat infrequently used construction. Even so, it does appear, and if our analyses are to be complete we must include as many rules as necessary. Examine the following sentences:

- (55) IT surprised us.
He draws pictures rapidly. --> His rapid drawing of the pictures surprised us.
- (56) I approved of IT.
He went. --> I approved of his going.
- (57) IT annoyed his mother.
He went to the party. --> His going to the party annoyed his mother.
- (58) I objected to IT.
Tom complains continuously. --> I objected to Tom's continuous complaining.
- (59) I heard about IT.
John had stolen a new car. --> I heard about John's having stolen a new car.

The formation of the gerundive nominal from a constituent sentence seems to require the following changes:

- 1) the change of the N_s-subject to the appropriate determiner (he--> his, she--> her, I--> my, . . .), or the change of the Nom-subject to its genitive (ET-8) form (Mary--> Mary's, Jack--> Jack's, the

man--> the man's, the girl--> the girl's);

- 2) the change of the Vb to the -ing + Vb form (Note: some gerundive nominals also have an additional -al + Vb form which is derived from the -ing + Vb form; for example:
Howard arrives.--> Howard's arriving--> Howard's arrival;
He peruses the book.--> His perusing of the book--> His perusal of the book.);
- 3) the change of the Nom-object following Tns + V_{tr} into the periphrastic genitive (ET-8) of + the + Nom-object (following Tns + have + en + V_{tr}, however, the Nom-object does not change form at all, but follows in its original form the -ing + have + en + V_{tr} form of the verb.);
- 4) the change of Adj + ly (if it occurs in the constituent) to Adj and its obligatory placement between the determiner (or -s genitive) and the -ing form of the verb;
- 5) the retention of any Adv element (Loc, Mot, Tm, or Man (other than Adj + ly)) in its original form following the verb or verb + complement. Like the infinitive, the gerundive nominal may appear as a purposive:
 - (60) I have a technique for IT. --> I have a technique for organizing facts.
I organize facts.
 - (61) I have a talent for IT. --> I have a talent for rapidly painting sunsets.
I paint sunsets rapidly.
 - (62) I have a knack for IT. --> I have a knack for getting into trouble.
I get into trouble.

When it appears as a purposive, the gerundive nominal:

- 1) does not change the N_s-subject into the appropriate determiner nor does it change the Nom-subject into the -is genitive, but instead deletes the Ns or Nom entirely;
- 2) does not change the Nom-object after Tns + V_{tr} into of + the + Nom-object, but instead retains it in its original form;
- 3) does not change any Adj + ly in the constituent to Adj, but instead retains it in the original form, though its position as Adj + ly may be immediately before the -ing form of the verb or immediately after the transformed constituent.

We now have two new rules to add to the list of NOM replacement transformations:

ET-19: Gerundive Nominal.

ET-20: Gerundive Nominal of Purpose.

The final construction in the section dealing with Nom replacement transformations is the abstractive nominal. This structure

has its origin in a complex sentence in which an A + C is expanded into an Adj + Infinitive. The Adj + Infinitive is then nominalized:

(63) The man is reluctant to go --> ^{Adj + Infinitive} The man's reluctance to go. . .
and inserted into an IT-slot in a waiting matrix sentence like:

(64) I admired IT.

to produce a new complex sentence:

(65) I admired the man's reluctance to go.

It will be noted that the Nom in the constituent sentence containing the Adj + Infinitive is transformed into its genitive form (-is), that the Adj is transformed into a Nom ending in -ance, and that the Infinitive is retained in its original form but now follows the Nom

ending in -ance. It would be well to note that if the Nom had been an N_s, the N_s would have been transformed into the appropriate determiner (he--- his, she--- her, I--- my, . . .) and that there are endings other than -ance for the nominalized adjective (-ness, -ence, -ity being some other common nominalized adjective endings). For example:

- (66) IT surprised me. --> His eagerness to depart surprised me.
 He was eager to depart.

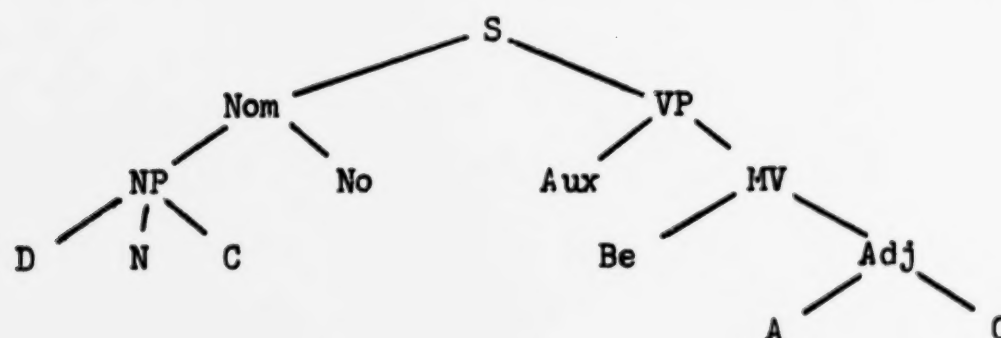
where He becomes His and the nominalized adjective form of eager is eagerness. Some of the adjectives in class A₂ (careful, clever, correct, ignorant, nasty, noble, prudent, sensible, silly, smart, (un)wise, wasteful, . . .) may be used in this construction, though many of these adjectives do not have a nominalized form.

We now conclude our description of Nom replacement transformations with the addition of this rule:

ET-21: Abstractive Nominal.

Expanding the Adj

The procedure for expanding the adjective is quite similar to that for the noun. Just as the C in the NP node provided for the embedding of the relative clause, the undeveloped C in the Adj node provides for the expansion of the adjective. Examine the following tree:



The A in this tree may be any of a number of adjectives that can have complements. Look at the following sentences:

- (67) The boy is eager + C. --> The boy is eager to go.
The boy goes.
- (68) My friend is happy about + C. --> My friend is happy about
My friend comes to visit me. coming to visit me.
- (69) George is tired of + C. --> George is tired of sleeping late.
George sleeps late.
- (70) He is free + C. --> He is free to go to school.
He goes to school.
- (71) I am happy + C. --> I am happy that George left the room.
George left the room.
- (72) George is tired of + C. --> *George is tired (of) to sleep
George sleeps late. late.
- (73) He is impatient for + C. --> *He is impatient for going
He goes to the show. to the show.

There are three structures here that will concern us: Adj + Inf, Adj + gerundive, and Adj + that clause. Not all adjectives can appear in all three structures, as the examples illustrate. We may add these three rules:

ET-22 - Adjective + Inf

ET-23 - Adjective + that clause

ET-24 - Adjective + Gerundive

Expanding the verb

In the generative grammar, there are several types of V_{tr}'s and V_{in}'s which carry with them an obligatory C, the undeveloped symbol which provides for the expansion of the term to which it is attached. So far in this manual, we have found the C attached to Nom's (providing for relative clauses ET-1, 3, 5) and adjectives (providing for infinitival, gerundive, and that-clause complements: ET-22, 23, 24). We now examine closely the expansion of certain transitive and intransitive verbs which require the development of an obligatory C from a

second constituent sentence. The complement (C) can be a number of things depending on the type of V_T or V_{in} chosen. The following sentences are examples of the V_T's and V_{in}'s we will examine.

(74) I caught him stealing the money. (V_T taking a telescoped progressive)

(75) She prevented her brother from ruining his life. (V_T taking a preposition and an -ing phrase nominalization.)

V_{Tc} C

(76) I advised Tom to study for the test. (V_T taking a telescoped future)

V_{Td} C

(77) I considered him to be my friend. (V_T taking an infinitive complement derived from constituent sentence in which Aux = Ths)

V_{Te} C

(78) The teacher let me bring my notes to class. (V_T taking an unmarked infinitive complement.)

V_{Tr} C

(79) He called me a fool. (V_T taking a telescoped copular constituent)

V_{Tg} C

(80) I painted the house white. (V_T taking a telescoped adjective complement)

V_{Th} C

(81) I put the car in the garage. (V_T taking a telescoped Loc complement)

V_{in} C

(82) She kept talking. (V_{in} taking an -ing complement)

V_{in} C

(83) She stood there thinking. (V_{in} taking an -ing complement)

V

(84) She ran down the hall screaming. (V_{in} taking an -ing complement)

In each of the example sentences, we have a complex sentence in which C has its origin in a constituent kernel sentence. For example, the two kernel sentences underlying (74) are I caught + C him and He was stealing the money., while the two kernel sentences

underlying (84) are She ran + C down the hall and She was screaming.

Let us take up the examination of the various types of V_T's and V_{in}'s individually. English verbs of the type V_{Ta} + C take a nominal object and an -ing complement derived from a constituent sentence whose MV is progressive (i.e., BE + ING has been selected from Aux). The constituent sentence must also contain as nominal subject a Nom identical to the object Nom in the matrix sentence. For example:

M: I caught + C him. --> I caught him stealing the
C: He was stealing the money. money.

You will notice that in the constituent sentence, the Nom subject (He) is identical to the Nom object in the matrix (him), and the MV of the constituent has as part of its Aux BE + ING (was stealing). These V_{Ta} + C verbs are said to take a telescoped progressive complement (i.e., the constituent sentence containing an MV with a progressive Aux has been collapsed (like a telescope) into ING + MV + X, and this telescoped progressive remnant of the constituent now replaces the C in the matrix sentence). V_{Ta} + C verbs taking a telescoped progressive complement include the following: BEHOLD, CATCH, DISCOVER, FEEL, FIND, HEAR, KEEP, LEAVE, NOTICE, OBSERVE, OVERHEAR, PERCEIVE, SEE, SHOW, SMELL, WATCH. We now list our first verb expansion transformation rule:

ET-25: V_{Ta} + C, where C = telescoped progressive complement.

Another class of V_T + C verbs, V_{Tb} + C, takes a nominal object and a complement consisting of a preposition and an -ing phrase derived from a constituent kernel sentence. For example:

M: She prevented from + C her brother. --> She prevented her
C: Her brother ruined his life. brother from ruining his life.

You will notice that the nominal object in the matrix sentence (her brother) is identical to the nominal subject in the constituent sentence (Her brother). Further, you will notice that, unlike the telescoped progressive $V_{Ta} + C$ verbs whose constituent sentence has an MV in the progressive form, this class of $V_T + C$ verbs chooses a constituent whose MV is not in the progressive form. This explains the fact that there are constituent sentences whose MV's cannot be in the progressive form, but which yet provide complements for $V_{Tb} + C$ verbs. For example, I accused him of knowing her has as its underlying constituent sentence He knew her, not *He was knowing her. Furthermore, complements after $V_{Tb} + C$ verbs like accuse of may contain Aux elements not to be found in simple progressive sentences. For example, I accused him of having written the letter has as its underlying constituent sentence He had written the letter, not *He was having written the letter. These $V_{Tb} + C$ verbs include the following: DISCOURAGE FROM, DISSUADE FROM, HINDER FROM, PREVENT FROM, SAVE FROM, STOP FROM; COAX INTO, COERCE INTO, PROVOKE INTO; ACCUSE OF, ACQUIT OF, CURE OF, SUSPECT OF. We now add our second verb expansion transformation rule to the list:

ET-26: $V_{Tb} + C$, where C = preposition plus -ing phrase.

Another large class of $V_T + C$ verbs -- $V_{Tc} + C$ -- takes a nominal object and an infinitive complement -- TO plus verb stem (to go, to play, to run, . . .). For these, the constituent sentence which furnished the infinitive complement seems to require the MV to be preceded by the auxiliary BE + TO, where the TO is retained in the complement after the BE word has been deleted. For example:

M: I advised + C Tom

C: Tom is to study for the test. --> I advised Tom to study
for the test.

You will notice that, like the $V_{Ts} + C$ and the $V_{To} + C$ verbs, the nominal object (Tom) in the matrix sentence is identical to the nominal subject (Tom) in the constituent sentence. Because the auxiliary BE + TO seems to convey a semantic sense of futurity in English, and since the nominal subject and the BE word in the constituent seem to be deleted as part of the process of creating the complement to fill the C position in the matrix sentence, this construction has been called the telescoped future. However, to distinguish it from the next class of $V_T + C$ verbs, we might better refer to $V_{Tc} + C$ verbs as those taking an infinitive complement derived from a constituent in which Aux is BE + TO. These verbs will probably be referred to, however, as telescoped futures, since that term is considerably shorter than infinitive complements derived from constituents in which Aux is BE + TO. The $V_{Tc} + C$ verbs include the following: ADVISE, ALLOW, APPOINT, ASK, AUTHORIZE, BECKON, BEG, BELIEVE, BID, BRIBE, CAUSE, CAUTION, CHOOSE, COMMAND, COMMISSION, COMPEL, DARE, DEFY, DESIRE, DESTINE, DIRECT, EMPOWER, ENABLE, ENGAGE, ENTICE, ENTREAT, EXHORT, EXPECT, GET, HELP, HIRE, INDUCE, INSTRUCT, INTEND, INVITE, LEAD, LEAVE, MEAN, NEED, ORDER, COMMIT, PERSUADE, PREFER, PRESS, PROMPT, PROVOKE, REQUEST, SENTENCE, SUMMON, TEACH, TELL, TEMPT, TRUST, URGE, WANT, WARN, WISH. We now add a third transformation rule to our list of verb expansion rules:

ET-27: $V_{Tc} + C$, where C = an infinitive complement derived from a constituent in which Aux is BE + TO.

There is another class of $V_T + C$ verbs which resemble the

V_{Tc} + C verbs. For example, I hated him to do that and I considered him to be my friend appear to be the same construction as I advised Tom to study for the test; each of these examples have verbs which are followed by a nominal object and an infinitive complement. However, the derivation of the first two examples differs from the derivation of the third example (V_{Tc} + C verb) in the choice of constituent sentences which provide the infinitive complement. While V_{Tc} + C verbs take constituent sentences with the BE + TO, HATE and CONSIDER take constituent sentences which have only Tns as auxiliary. For example:

M: I considered + C him. --> I considered him to be my friend.
C: He is my friend.

and

M: I hated + C him. --> I hated him to do that.
C: He did that.

You will notice that the constituent sentence of I considered him to be my friend is He is my friend, not He is to be my friend; similarly, the constituent sentence of I hated him to do that is He did that, not He was to do that. This group of verbs -- V_{Td} + C -- can be thought of as taking an infinitive complement derived from constituents in which Aux is Tns to distinguish them from V_{Tc} + C verbs which require constituents having BE + TO as Aux. These V_{Td} + C verbs include the following: HATE, LIKE, LOVE, (general); CONSIDER, DECLARE, JUDGE, KNOW, SUPPOSE, SUSPECT (copular). The V_{Td} + C group labeled general may take any constituent sentence in which Aux is Tns to provide the infinitive complement, while the V_{Td} + C group labeled copular require the constituent V to be BE. We now add our third verb expansion transformation rule to the list:

ET-28: V_{Td} + C, where C = an infinitive complement derived from a constituent sentence in which Aux = Tns.

Another class of $V_T + C$ verbs -- $V_{Te} + C$ -- is followed by a nominal object and an unmarked infinitive complement derived from a constituent sentence. The term unmarked infinitive refers to a tenseless verb-phrase having neither TO or - ING added (GO rather than TO GO or GOING, PLAY rather than TO PLAY or PLAYING, . . .). This class of $V_{Te} + C$ verbs is small in number, but most of them are quite common and include the following: BID, FEEL, HAVE, HEAR, LET, MAKE, NOTICE, OVERHEAR, SEE, WATCH. For example:

M: The teacher let + C me.
 C: I brought my notes to class. --> The teacher let me bring my notes to class.

and

M: I saw + C him. --> I saw him do it.
 C: He did it.

and

M: She made + C him. --> She made him lose his job.
 C: He lost his job.

In each of these examples, you will note that the nominal object in the matrix sentence is identical with the nominal subject in the constituent; you will also notice that instead of the infinitive form of the constituent verb making up the complement in the complex sentence, only the tenseless verb-stem appears; i.e., BRING rather than TO BRING, DO rather than TO DO, and LOSE rather than TO LOSE. It is the appearance of BRING, DO and LOSE, rather than TO BRING, TO DO, and TO LOSE, that gives us the term unmarked infinitive. Further evidence that the complement form is the infinitive form of the constituent verb is the reappearance of the TO in the passive transformation of some of the complex sentences formed by $V_{Te} + C$ verbs; for example, the passive of I MADE HIM PLAY THE PIANO FOR US. is not *HE WAS MADE PLAY THE PIANO FOR US., but HE WAS MADE TO PLAY THE PIANO FOR US. We now add a fourth verb expansion transformation rule to the list:

ET-29: $V_{Te} + C$, where C = an unmarked infinitive complement derived from a constituent sentence.

A number of V_{Tf} + C verbs require a copular constituent sentence to be telescoped to provide the complement in the complex sentence. This means that these verbs require the nominal object of the matrix sentence to be identical with the nominal subject of the constituent sentence and also require the MV in the constituent sentence to be copular (BE + Pred). For example:

M: He called + C me. --> He called me a fool.
C: I am a fool.

and

M: He appointed + C John. --> He appointed John captain.
C: John is the captain.

You will notice that the constituent sentence in both examples is telescoped; that is, the nominal subject and the BE word is deleted and only the Pred element becomes the complement in the complex sentence. You will further notice that after V_{Tf} + C verbs like APPOINT that the determiner preceding the nominal in the Pred is deleted also. The constituent sentences for this V_{Tf} + C class of verbs are a very specifically determined set: for verbs like APPOINT, CROWN, NOMINATE, the constituent Pred is a military or political title; for verbs like BAPTIZE, CALL, CHRISTEN, DUB, NAME, the constituent Pred is a proper name; the rest of the verbs taking a telescoped copular Pred as complement may take more generally defined copular constituents: these verbs include CALL, CONSIDER, DECLARE, ESTEEM, JUDGE, KEEP, LEAVE, MAKE, PRESUME, PROCLAIM, PRONOUNCE, PROVE, PUT, REPORT, SEE, SUPPOSE, THINK, WANT, WISH. We now add a fifth verb expansion transformation rule to the list:

ET-30: $V_{Tf} + C$, where C = a telescoped copular constituent sentence.

The next class of $V_T + C$ verbs -- $V_{Tg} + C$ -- requires, like the other $V_T + C$ verbs, that the nominal object in the matrix sentence be identical to the nominal subject in the constituent; however, the MV in the constituent sentence must be BE + Adj to provide the telescoped adjective complement in the resulting complex sentence. For example:

M: I painted + C the house. --> I painted the house white.
C: The house is white.

and

M: The sun kept + C us. --> The sun kept us warm.
C: We were warm.

As in other telescoped constructions, you will notice that the nominal subject and the BE word are deleted, leaving only the Adj to provide the complement. These $V_{Tg} + C$ verbs include the following: CHURN, COLOR, DISCOVER, FIND, GET, KEEP, MAKE, PAINT, SHOW, SPIN, TURN, WORK. We now add a sixth verb expansion transformational rule to the list:

ET-31: $V_{Tg} + C$, where C = a telescoped adjective complement derived from a copular constituent in BE + Adj.

The final class of $V_T + C$ verbs-- $V_{Th} + C$ --presents a somewhat special problem. Looking at (81) again (I put the car in the garage), you might wonder why in the garage could not simply be a Loc in a kernel sentence. Look closely at these three sentences:

- (85) They hit the boy on the head.
- (86) They admired the book on the shelf.
- (87) They put the car in the garage.

In each case we have what appears to be a kernel sentence in which a Loc has been optionally chosen. If this is so, then the Loc could be deleted and we would have an acceptable kernel sentence. When we attempt to do this, we get:

- (88) They hit the boy.
- (89) They admired the book.

but not *(90) *They put the car.

Whenever a Nom is followed by a prepositional phrase, such as on the head, on the shelf, in the garage, it is always possible that the prepositional phrase had its origin in another kernel sentence and is replacing a C in a kernel matrix sentence. For example:

M: They put + C the car.
C: The car is in the garage. --> They put the car in the garage.

You will notice that the nominal object in the matrix sentence is identical to the nominal subject in the constituent sentence and that like other telescoped constructions, the nominal subject and the BE word in the constituent are deleted, leaving the Loc prepositional phrase to become the complement in the complex sentence. These V_{Th} + C verbs which take a telescoped Loc complement seem to be few in number: KEEP, LEAVE, PUT. We now add a seventh verb expansion transformational rule to the list:

ET-32: V_{Th} + C, where C = a telescoped Loc complement derived from a constituent sentence in BE + Loc.

The last set of verbs which take complements derived from a constituent sentence are the V_{in} + C verbs. In HE ENJOYED SWIMMING, SWIMMING is a nominalization of a constituent sentence HE SWIMS, derived from the ET-19 gerundive nominal transformational rule:

M: He enjoyed it. --> He enjoyed swimming.
C: He swims.

However, in HE KEPT SWIMMING, SWIMMING is a verbal complement derived from a constituent sentence HE WAS SWIMMING in the following manner:

M: He kept + C.
C: He was swimming. --> He kept swimming.

There are several reasons for this careful distinction between HE ENJOYED SWIMMING (a Nom replacement by nominalization of the constituent sentence by ET-19 rule) and HE KEPT SWIMMING (a verb expansion by telescoping the nominal subject and the BE word of the constituent sentence by ET-33 rule, yet to be developed). First, there is a pronominal expression associated with HE ENJOYED SWIMMING, namely, HE ENJOYED IT; however, HE KEPT IT is not the pronominalized partner of HE KEPT SWIMMING. Second, there is a passive transformation possible with HE ENJOYED SWIMMING, namely, SWIMMING WAS ENJOYED (BY HIM); there is no such passive transform of HE KEPT SWIMMING, namely, no *SWIMMING WAS KEPT (BY HIM). Therefore, the -ING phrase after ENJOY must clearly be interpreted as a nominalized noun replacement, and the -ING phrase following KEEP must just as clearly be interpreted as an intransitive verb complement. These V_{in} + C verbs taking an -ING complement include the following:

BEGIN, CEASE, COMMENCE, CONTINUE, FINISH, GIVE UP, KEEP, KEEP ON, PRACTICE, START, STOP; LIE, RUN, STAND, . . . We now add the final verb expansion transformational rule to the list:

ET-33: $V_{in} + C$, where C = an -ING complement derived from a constituent MV in the progressive (BE + ING) form.

This completes our discussion of verb expansion transformational rules. As a quick means of summarizing these various structures, we now list all of them below with an example of a complex sentence produced by each rule.

- ET-25: $V_{Ts} + C$ (telescoped progressive: I caught her leaving the room.)
- ET-26: $V_{Tb} + C$ (preposition with an -ing phrase: I stopped her from leaving the room.)
- ET-27: $V_{Tc} + C$ (telescoped future: I told her to leave the room.)
- ET-28: $V_{Td} + C$ (infinitive complement derived from constituent sentence in which Aux = Tns: I knew her to be my enemy.)
- ET-29: $V_{Te} + C$ (unmarked infinitive complement: I made her leave the room.)
- ET-30: $V_{Tf} + C$ (telescoped copular constituent: I named her chairman.)
- ET-31: $V_{Tg} + C$ (telescoped adjective complement: I made her angry.)
- ET-32: $V_{Th} + C$ (telescoped Loc complement: I put the book on the shelf.)
- ET-33: $V_{in} + C$ (telescoped -ing complement: She stood there crying.)

Replacing the Adverb

In the kernel grammar Loc, Tm, Man, and Mot may be optionally selected as a part of MV and obligatorily chosen after certain intransitive verbs ($V_{il} + Loc$, $V_{im} + Mot$). For example, we may have:

- (88) He hit the ball (over the fence).
- (89) He stood there (in the corner).
- (90) He ran (across the field).
- (91) He threw the ball (wildly).

In the production of a sentence in which Loc, Tm, Man, or Mot is selected, it is often possible to replace one of these ADV's by a sentence to which the proper WH-transformation has been applied,

provided the matrix contains an undeveloped Loc, Tm, Mot, or Man, and provided that the constituent contains the same ADV element as the matrix. For example,

M: We play ball + Loc.
C: John plays ball in the park. --> We play ball where John plays ball.

You will notice that the matrix contained an undeveloped Loc and that the constituent contained a Loc phrase IN THE PARK, which was subsequently WH'd to produce the Wh-word where. The entire constituent sentence (after IN THE PARK was WH'd) replaces the undeveloped Loc in the matrix to produce the complex sentence WE PLAY BALL WHERE JOHN PLAYS BALL. It is possible then to have embedded sentences beginning with where (ever), replacing Loc or Mot; when(ever), replacing Tm; and how(ever), replacing Man.

For example,

- (92) M: You may go + Loc.
C: You want to go to the show. --> You may go where(ever) you want to (go).
- (93) M: You may go + Tm.
C: You want to go tomorrow. --> You may go when(ever) you want to (go).
- (94) M: We play ball + Tm.
C: Summer comes this year. --> We play ball when(ever) summer comes.
- (95) M: He plays the game + Man.
C: He wants to play the game unfairly. --> He plays the game how(ever) he wants to (play the game).

Sentences which are embedded in a matrix containing a TM undeveloped may begin with such Tm-words as after, before, while and as. For example,

- (96) M: I am going home + Tm.
C: The game has been completed this afternoon. -->
I am going home after the game has been completed.

- (97) M: I went home + Tm. --> I went home before
 C: The game began at 2 o'clock. the game began.
- (98) M: I saw your friend + Tm. -->
 C: I walked down the street then.

I saw your friend while I was walking down the street.

We have, then, a transformational rule for replacing the ADV, whether it be Loc, Mot, Tm, or Man:

ET-34: Adverbial Replacement (LOC, TM, MOT, MAN).

In the expansion of ADV in the phrase structure grammar the undeveloped symbol ϕ provides for a second type of adverbial embedment. In the production of a sentence, the native speaker of English may wish to use a second sentence that is closely related to the first sentence. He might do this in the following way:

- (100) M: The boy is happy + ϕ . --> The boy is happy because
 C: The girl smiled at him. the girl smiled at him.

In this example, the undeveloped ϕ was replaced by because + S; it may be replaced in other examples with although + S, though + S, even though + S, if + S, as if + S, as though + S, for + S. For example,

- (101) M: I admired her + ϕ . ----> I admired her because
 C: She was honest. she was honest.
- (102) M: I got credit for English + ϕ . --> I got credit for
 C: I wrote no better this year. English although I
wrote no better this
year.
- (103) M: She read her speech + c. -->
 C: She were really interested in her topic.
 She read her speech as if she were really interested in
her topic.
- (104) M: He knew the answer + ϕ . --> He knew the answer for
 C: He had studied hard. he had studied hard.
- (105) M: I would tell you + ϕ . --> I would tell you if I
 C: I knew the answer. knew the answer.

Thus, we have a second transformational rule for replacing the ADV:

ET-35: Adverbial Replacement (4).

Expanding the Adverb

The phrase structure rules already provide for the expansion of ADV into Man + C, where Man is so + Adj + ly and where C is replaced with that + S. For example,

- (106) M: The team fought so tenaciously + C.
C: It won the game. -->

The team fought so tenaciously that it won the game.

- (107) M: She stroked the ball so fiercely + C. ----->
C: It broke the net.

She stroked the ball so fiercely that it broke the net.

- (108) M: The lawyer spoke so rapidly + C. -->
C: He confused the jury.

The lawyer spoke so rapidly that he confused the jury.

You will notice in each example that the Man-word (usually Adj + ly) is preceded by so and that the constituent sentence is attached to the matrix at the C slot by prefixing it with that. We now add the last embedding transformational rule to the list:

ET-36: Adverbial Expansion of Man + C.

LIST OF EMBEDDING TRANSFORMATIONS

NOUN EXPANSION	1 - Relative Clause (be)
	2 - Adjective (by deletion and obligatory placement)
	3 - Relative Clause (Have)
	4 - With-phrase (by simple transformation of ET-3)
	5 - Relative Clause (V_b)
	6 - Gerundive Adjective (by deletion and optional placement)
	7 - Compounds
	8 - Genitives

NOUN REPLACE- MENT	9 - That + S (Subject)
	10a- (That) S (Object)
	10b- That + S (Object)
	11 - WH + S (Subject)
	12 - WH + S (Object)
	13 - WH + Inf (Subject)
	14 - WH + Inf (Object)
	15 - Nominal Inf of Obligation
	16 - Inf (Subject)
	17 - Inf (Object)
	18 - Inf (Purpose)
	19 - Gerundive Nominal
	20 - Gerundive Nominal of Purpose
	21 - Abstractive Nominal

ADJEC- TIVE EXPANSION	22 - Adjective + Inf
	23 - Adjective + That-clause
	24 - Adjective + Gerundive

VERB EXPAN- SION	25 - V_{Ta}	(I caught him stealing the money.)
	26 - V_{Tb}	(I prevented him from stealing the money.)
	27 - V_{Tc}	(I advised him to return the money.)
	28 - V_{Td}	(I considered him to be the thief.)
	29 - V_{Te}	(I let him return the money.)
	30 - T_{Tf}	(I called him a fool.)
	31 - V_{Tg}	(I made him angry.)
	32 - V_{Th}	(I put the car in the garage.)
	33 - V_{in+C}	(I kept on talking.)

ADVERBIAL	34 -Adverbial Replacement (<u>Loc</u> , <u>Tm</u> , <u>Mot</u> , <u>Man</u>)
REPLACEMENT	35 -Adverbial Replacement (<u>ϕ</u>)

ADVERBIAL EXPANSION	36 - Adverbial Expansion of <u>Man</u> + C.
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CONJOINING TRANSFORMATIONS

Any two sentences can be conjoined by such words as AND, BUT, OR, NOR, EITHER . . . OR, NEITHER . . . NOR, BOTH . . . AND, and NOT ONLY . . . BUT ALSO. For example,

- (109) M': The boat sank.
M'': We all swam ashore. --> The boat sank and we all swam ashore.
- (110) M': The boat sank.
M'': Nobody drowned. --> The boat sank but nobody drowned.
- (111): M': The boys swam.
M'': The girls swam. --> Neither the boys swam nor the girls swam.

In general, conjoining seems to be a very simple procedure in English; any two or more sentences can be joined together by the simple addition of one of the above conjoining words, sometimes called conjunctions. We will consider all conjoining to be accomplished by a single transformation, no matter which conjunction is used; we now add this conjoining transformational rule to the list:

CT-37: Conjoining, by means of AND, BUT, OR, NOR, EITHER. . . OR, NEITHER. . . NOR, BOTH. . . AND, and NOT ONLY. . . BUT ALSO.

DELETING TRANSFORMATIONS

Several of the embedding transformations and the conjoining transformation produce complex sentences from which certain elements are optionally deletable. We will examine these deleting transformations in order.

Common Elements:

You have been deleting common elements from your sentence auto-

matically for many years already. In the sentence I LEFT THE BREAD AND (I LEFT) THE POTATOES., the second I LEFT is deletable. In many cases like this one, when two sentences are conjoined, elements in the second matrix sentence which are common or identical to elements in the first are omitted or deleted.

For example,

- (112) Neither the boys swam nor the girls swam. ----->
Neither the boys nor the girls swam.
- (113) The boys went to the show and the girls went home. ----->
The boys went to the show and the girls home.
- (114) What he did can be told now and where he went can be
told now. -->
What he did and where he went can be told now.
- (115) His lonely hotel room seemed cold and his lonely
hotel room seemed damp. -->
His lonely hotel room seemed cold and damp.
- (116) The girls were purple but the boys were red. -->
The girls were purple but the boys red.
- (117) George shoots lions and George shoots tigers. -->
George shoots lions and tigers.
- (118) I saw Jim at the show but I saw John at the game. -->
I saw Jim at the show but John at the game.
- (119) She bought shoes downtown and she bought dresses down-
town but she bought gloves at the shopping center. -->
She bought shoes and dresses downtown but gloves at the
shopping center.
- (120) I bought milk at the store and I bought bread at the
store and I bought eggs at the store -->
I bought milk, bread and eggs at the store.

In example (120), you will notice that if you conjoin three sentences (or more) and then delete the common elements from the second and third matrix leaving only one word from each of these matrixes, you must put a comma between the first and second elements (milk, bread) but not

before the and joining the second to the third element (bread and eggs). It should be noted, however, that a comma before the and is optional, although the current trend is towards putting no comma there. For example:

(121) We saw lions, tigers, elephants and giraffes at the zoo.
and (122) We saw lions, tigers, elephants, and giraffes at the zoo.
Either example is correctly punctuated according to modern practice, but (121) is rapidly becoming the preferred procedure. We now add the FIRST deleting transformational rule to the list:

DT-38: Deletion of common elements in conjoined sentences.

Relative Clause Deletions:

WH + Aux + Be is deletable in almost all relative clauses in which the constituent sentence MV is BE. When the constituent sentence contains only Adj following the BE-word verb, the Adj must be moved and placed before nominal in the complex sentence. When the constituent sentence contains a nominal, a Loc word or phrase, or an Adj + C construction following the verb BE, that element may not be moved. For example,

- (123) The boy who is on the corner is my friend. -->
The boy on the corner is my friend.
- (124) The job which is presently available pays well. -->
The job presently available pays well.
- (125) The boy who is eager to study is needed in college. -->
The boy eager to study is needed in college.
- (126) The boy who is happy is healthy. -->
*The boy happy is healthy. --> The happy boy is healthy.
- (127) The boy who is a Boy Scout is my friend. -->
The boy, a Boy Scout, is my friend.

You will notice in example (127) that when the constituent verb Be is

followed by a nominal and when the WH-word + Aux + BE is deleted, the nominal must be surrounded by commas in the complex sentence.

In complex sentences in which the main verb of the relative clause is not BE, no deletion may occur unless the Aux is progressive, i.e., tns + be + ing; when the Aux is progressive, then the Wh-word + tns + be may be deleted in the relative clause. When the MV of the relative clause in the progressive form is V_b only, the V_b + ing (the gerundive adjective, ET-6) may be placed before the nominal in the complex sentence. For example,

- (128) The boy who is singing on the corner is my friend. -->
The boy singing on the corner is my friend.
- (129) The boy who has been singing at the club was very good. -->
The boy singing at the club was very good.
- (130) The boy who is running is my friend. -->
The boy running is my friend. OR The running boy is my friend.

We now add a second deletion transformational rule to the list:

DT-39: WH + BE deletion in relative clauses.

Adverbial Replacement Deletions:

There are a number of circumstances in which elements of adverbial replacements, either of the ET-34 or ET-35 variety, may be deleted.

For example,

- (131) We got a good tan while we were swimming. -->
We got a good tan while swimming.
- (132) We discussed politics while we were playing golf. -->
We discussed politics while playing golf.
- (133) When he was asked about it, he denied it completely. -->
When asked about it, he denied it completely.

In the case of constituent sentences that have been embedded in an undeveloped TM symbol in the matrix sentence (see examples (131) -

(133)), it seems possible to delete Nom + tns + Be, but only when the NOM's of the matrix and constituent sentences are identical.

For example, from a sentence such as:

(134) While we were swimming, a shark swam by.

there is no such sentence as:

(135) *While swimming, a shark swam by.

In general, it seems that the "dangling modifier" (as in example (135)) is a product of an adverbial embedment deletion in which the constituent and the matrix sentences have different NOM's: there is no such sentence in English like (136) *While running down the street, the sun felt hot. However, there is such a sentence like (137) While we were running down the street, the sun felt hot. In summary, then, we will say that in complex sentences containing an adverbial embedment in TM, it is possible to delete Nom + Aux + BE if, and only if, the matrix and constituent NOM's are identical.

The conditions under which complex sentences containing adverbial embedments in ϕ may undergo deletions are quite similar to those applying to the adverbial replacement in TM. In the case of adverbial embedments in ϕ in which the constituent sentence begins with a TM-word that serves as a clause-marker, it is possible to delete the Nom + Aux + Be. For example,

(138) As if he had been asked, he sat down to dinner with us. -->
As if asked, he sat down to dinner with us.

(139) Although I was tired, I agreed to listen to him. -->
Although tired, I agreed to listen to him.

(140) Even though he was running away, he stopped to eat lunch. -->
Even though running away, he stopped to eat lunch.

You will notice that, before the deletion of Nom + Aux + Be can take place in adverbial embedments in ϕ , the NOM's of the matrix and constituent sentences must be identical. Incidentally, you will notice in examples (133), (134), (137), (138), (139), and (140) that when a clause takes the place of an undeveloped ADV (Loc, Tm, Mot, Man) or ϕ and this clause is subsequently moved to the beginning of the complex sentence, a comma (,) separates the displaced clause from the rest of the complex sentence. We are now ready to add the last deletion transformational rule to the list:

DT-40: Adverbial Embedment Deletion, whether ADV (Loc, Tm, Mot, Man) or ϕ .

SIMPLE TRANSFORMATIONS

Simple transformations are applied only to single sentences. If the sentence is a kernel sentence, the simple transformation will make it a complex sentence. If the sentence is already complex, it of course remains complex after the application of the simple transformation. We shall examine several types of simple transformations.

Passive Transformation:

The passive transformation rule applied to a kernel sentence with a transitive verb or to an intransitive verb followed by a Prep + Nom construction would give a complex sentence like:

(141) The boy hit the ball. --> The ball was hit (by the boy).
or (142) The boy sat in the chair. --> The chair was sat in (by the boy). In example (141), the verb HIT is a V_{tr}, while in example (142), the verb SIT is a V_{in} followed by a Prep + Nom IN THE CHAIR. You will notice in each example that the final BY + Nom phrase is optionally deletable; this seems to be characteristic of all passive transforms.

There is a particular V_{tr} , however, which produces two passives instead of the usual one. The V_{tiot} verb has as one of its alternate forms a sentence in which the to has been dropped; for example, GIVE is a V_{tiot} verb and this sentence: (143) HE GAVE THE BOOK TO ME has an alternate form: (144) HE GAVE ME THE BOOK. This second form, example (144), has two passives:

(145) I was given the book by him.

and (146) The book was given me by him.

To allow for both of these passives, the general rule will be written in this way:

$$\begin{array}{ccccccc} \text{Nom}' + \text{tns} & \left\{ \begin{array}{l} V_{in} + \text{Prep} \\ V_{tiot} \\ V_{tr} \end{array} \right\} & + & \text{Nom}'' + X & \longrightarrow & \text{Nom}'' + \text{tns} + \text{BE} + \text{EN} + & \left\{ \begin{array}{l} V_{in} + \text{Prep} \\ V_{tiot} \\ V_{tr} \end{array} \right\} + X + (\text{by} + \text{Nom}') \\ \underline{1} & \underline{2} & & \underline{4} & & \underline{4} & \underline{2} & \text{BE} + \text{EN} & & \underline{3} & \underline{5} & (\text{by} + \underline{1}) \end{array}$$

Thus, in the sentence HE GAVE ME THE BOOK, either GAVE (the V_{tiot}) or GAVE ME (the V_{tr}) can be selected as element 3. If the V_{tiot} GAVE is chosen, the analysis of the sentence will be:

$$\begin{array}{ccccccc} \text{He} + \text{past} + \text{GIVE} + \text{me} + \text{the book} & \longrightarrow & \text{I} + \text{past} + \text{BE} + \text{EN} + \text{GIVE} + \text{the book} + \text{by him} \\ \underline{1} & \underline{2} & \underline{3} & \underline{4} & \underline{5} & & \underline{4} & \underline{2} & & \underline{3} & \underline{5} & & \underline{1} \end{array}$$

He gave me the book $\longrightarrow$ I was given the book by him.

If the V_{tr} GAVE ME had been chosen, the analysis of the sentence would be:

$$\begin{array}{ccccccc} \text{He} + \text{past} + \text{GIVE ME} + \text{the book} + \emptyset & \longrightarrow & \text{The book} + \text{past} + \text{BE} + \text{EN} + \text{GIVE ME} + \emptyset + \text{by him} \\ \underline{1} & \underline{2} & \underline{3} & \underline{4} & \underline{5} & & \underline{4} & \underline{2} & & \underline{3} & \underline{5} & & \underline{1} \end{array}$$

He gave me the book $\longrightarrow$ The book was given me by him.

This rule may now be listed as the first simple transformational rule:

ST-41: Passive Transformation of sentences in $V_{in} + \text{Prep}$, V_{tr} , or V_{tiot} .

It-Inversion Transformation:

The It-Inversion is applied only to complex sentences in which a constituent sentence was embedded in the subject position of a matrix sentence as a That + S, WH + S, or an Inf as Subject. For example:

- (a) IT is surprising.
- (b) We won the game.
- (c) That we won the game is surprising.
- (147) It is surprising that we won the game.

- (a) It seems unnecessary these days.
- (b) They play football with vigor.
- (c) To play football with vigor seems unnecessary these days.
- (148) It seems unnecessary to play football with vigor these days.

- (a) IT bothered him.
- (b) He had done something to the team's morale.
- (c) What he had done to the team's morale bothered him.
- (149) It bothered him what he had done to the team's morale.

In each set, the kernel sentences (a) and (b) produce a complex sentence (c). The complex sentence (c) is then inverted, i.e., its elements are re-ordered: Nom + VP --> It + VP + Nom through IT inversion. We now add this simple transformational rule to the list:

ST-42: It-Inversion of complex sentences in That + S, WH + S, and Inf as Subject.

There-Inversion Transformation:

The There-Inversion transformation is similar to the It-Inversion transformation above, except that the There-Inversion can be applied to both kernel and complex sentences. For example:

- (150) A man is there. --> There is a man there.
- and (151) To ban the bomb is a movement among liberals. -->
There is a movement among liberals to ban the bomb.

In the complex sentence (151), the There-Inversion re-orders the elements much as the It-Inversion does:

Nom + VP --> There + VP + Nom.

In the kernel sentence (150), the re-ordering of the elements is somewhat different: Nom + MV + Comp --> There + MV + Nom + Comp.

We now list this second inversion transformation rule:

ST-43: There-Inversion of kernel or complex sentences.

Question-Transformation:

This transformation appears in two major forms: the yes-no question (i.e., the question that is produced may be answered by "yes" or "no") and the WH-question. From this kernel sentence

(152) The cowboy saw a mirage suddenly in the desert yesterday.
 Nom' V_{tr} Nom" Man Loc Tm

the following six questions can be derived:

(153) (yes-no) Did the cowboy see a mirage suddenly in the desert yesterday?

(154) (WH + Nom') Who saw a mirage suddenly in the desert yesterday?

(155) (WH + Nom") What did the cowboy see suddenly in the desert yesterday?

(156) (WH + Man) How did the cowboy see the mirage in the desert yesterday?

(157) (WH + Loc) Where did the cowboy see the mirage suddenly yesterday?

(158) (WH + Tm) When did the cowboy see the mirage suddenly in the desert?

If Nom' + past + V_{tr} + Nom" + Man + Loc + Tm represents sentence

(152), then the yes-no question is produced by the transform

past + Nom' + V_{tr} + Nom" + . . .?, where the pro-verb did replaces

the past-morpheme when it has been shifted to the initial position

in the question transform. All the WH-questions, except (153), are

produced by the transform $WH \left\{ \begin{array}{c} \text{Loc} \\ \text{Man} \\ \text{Tm} \end{array} \right\} + \text{past} + \text{Nom}' + V_{tr} + \text{Nom}'' \dots?$,

where once again the pro-verb did replaces the past-morpheme when it has been shifted away from the main verb. Sentence (154) is produced by the question-transform $WH + \text{Nom}' + \text{past} + V_{tr} + \text{Nom}'' + \dots?$, where there is no need to shift the past-morpheme away from the main verb when the first Nom is WH'd. When Nom'' is WH'd and shifted to the initial position in the question-transform, it becomes WHAT if Nom'' is inanimate, but WHOM if Nom'' is animate. We are now ready to add the question-transform rule to the list:

ST-44: Question transformation, either yes-no or WH-question.

Negation Transformations

The first of the negation transformations simply makes a negative statement out of a positive one. If we use example sentence (152) in the form Nom' + past + VP, then to make this form negative we simply add NOT or N'T: Nom' + past + NOT + VP. The separation of the

N'T

past-morpheme from the main verb by NOT or N'T requires the use of the pro-verb did so that the final form of the negation-transform is:

NOM' + DID NOT + VP. In case the Tns-morpheme is pres, the pro-DIDN'T

verb is DO(ES) and the negation transform is NOM' + DO(ES) NOT + VP.
DO(ES)N'T

(159) The cowboy saw a mirage in the desert. -->
The cowboy did not see a mirage in the desert. OR
The cowboy didn't see a mirage in the desert.

(160) I see him standing over there. -->
I do not see him standing over there. OR
I don't see him standing over there.

(161) He sees that he will have to leave now. -->
He does not see that he will have to leave now. OR
He doesn't see that he will have to leave now.

We add the first negation transformational rule to the list:

ST-45: Negation of simple or complex sentences.

Negation-shift transformation:

There are a number of $V_T + C$ verbs which permit the negation word NOT or N'T in the complement derived from the constituent sentence to shift its position from the complement and become attached to the main verb in the matrix sentence. For example:

- (162) M: I advised + C him.
C: He was not to leave the room. -->
- (a) I advised him not to leave the room. -->
(b) I didn't (did not) advise him to leave the room.
- (163) M: I supposed + C him.
C: He is not my friend. -->
- (a) I supposed him not to be my friend. -->
(b) I didn't (did not) suppose him to be my friend.
- (164) M: I expect + C him.
C: He will not lose the game. -->
- (a) I expect him not to lose the game.
(b) I don't (do not) expect him to lose the game. -->

The shift of the NOT or N'T to the matrix verb is optional with these verbs, so either (a) or (b) complex sentence in the examples (162) - (164) are correct. The $V_T + C$ verbs which permit this optional negation-shift include the following: ADVISE, APPEAR, BELIEVE, CHOOSE, CONSIDER, DESIRE, EXPECT, IMAGINE, INTEND, LIKE, SEEM, SUPPOSE, THINK, WANT, WISH.

We now add this second negation-transformational rule to the list:

ST-46: Negation-shift from complement to matrix verb in some $V_T + C$ verbs.

AREAS TO STUDY

We have identified and discussed in some detail the forty-six transformations that produce most of the non-kernel sentences in the

language. Our main task now is to use our knowledge of this transformational component (and of the phrase structure component) of the generative grammar to analyze writing style. Such questions as the following should guide our study:

1. Will the classes of transformations--Embedding, Conjoining, Deleting, Simple--appear in some discernible pattern for writers on a given level? For example, will tenth grade writers have a different mix of classes from that of sixth grade? of twelfth grade, of professional? Can such a mix or pattern be described precisely? How?

2. Within a class of transformations--like the ET's, for example--will the specific transformations appear in some patterns for writers at different levels? Are some transformations more revealing of style than others? How much prose needs to be analyzed to discover such patterns?

3. Can a single score be developed from this analysis that would indicate the relative richness or complexity of the writer's style? How would such a score or index be tested?

4. ANALYSIS OF DATA

The Writing Sample

Samples of writing were collected throughout the two-year period of the experiment. Approximately 70,000 words were analyzed. Before-samples were collected during the first three months of the experiment and After-samples were collected during the last three months. All writing was produced by the pupils as part of class assignments. In each class improvement in pupil writing was one of the major objectives. The classes differed only in content: no formal grammar was studied in the control class; the grammatical content described in Chapters 2 and 3 was studied by the pupils in the experimental class.

Table 1

<u>Total Words in Samples of Writing</u>							
<u>Control Class</u>				<u>Experimental Class</u>			
	<u>Before</u>	<u>After</u>	<u>Total</u>		<u>Before</u>	<u>After</u>	<u>Total</u>
1	631	1687	2318	1	1124	968	2092
2	498	490	988	2	1233	722	1955
3	1258	732	1990	3	1844	765	2609
4	1057	706	1763	4	989	673	1662
5	707	980	1687	5	1357	1004	2361
6	673	737	1410	6	965	699	1664
7	653	1040	1693	7	705	268	973
8	674	575	1249	8	1417	894	2311
9	1070	1065	2135	9	777	951	1728
10	706	716	1422	10	1162	823	1985
11	625	907	1532	11	1105	1120	2225
12	688	1038	1726	12	915	390	1305
13	698	671	1369	13	1062	1103	2165
14	620	1356	1976	14	530	853	1383
15	627	1075	1702	15	745	799	1544
16	605	1218	1823	16	1455	1009	2464
17	672	1058	1730	17	515	903	1418
18	819	887	1706	18	430	1107	1537
19	779	704	1483	19	575	759	1334
20	1069	660	1729	20	754	803	1557
				21	550	570	1120
Totals	15,129	18,302	33,431		20,209	17,183	37,392

Table 2

Before and After Frequencies of Sentences and Transformations

	Well-formed Sentences						Mal-formed Sentences					
	Before		After		Totals		Before		After		Totals	
	S's	T's	S's	T's	S's	T's	S's	T's	S's	T's	S's	T's
1	23	129	30	404	53	533	13	76	7	261	20	337
2	22	111	18	108	40	219	6	39	7	78	13	117
3	30	115	20	156	50	271	36	214	14	90	50	304
4	51	165	14	87	65	252	17	96	18	192	35	288
5	15	49	31	142	46	191	14	110	18	136	32	246
6	21	79	31	95	52	174	10	108	24	132	34	240
7	20	113	26	145	46	258	11	83	21	235	32	318
8	38	107	23	101	61	208	15	91	15	103	30	194
9	25	105	36	232	61	337	19	140	18	189	37	329
10	31	126	27	78	58	204	15	67	12	127	27	194
11	14	51	28	173	42	224	20	132	19	161	39	293
12	21	77	27	233	48	310	22	129	17	189	39	318
13	14	54	31	155	45	209	18	151	19	90	37	241
14	25	78	42	365	67	443	15	71	10	110	25	181
15	25	72	29	152	54	224	18	86	31	197	49	283
16	19	74	17	176	36	250	12	73	22	375	34	448
17	15	88	23	192	38	280	17	138	15	201	32	339
18	25	90	34	188	59	278	18	113	15	102	33	215
19	38	146	29	140	67	286	9	39	12	85	21	124
20	33	122	39	119	72	241	40	176	12	88	52	264

Totals 505 1951 555 3441 1060 5392 345 2132 326 3141 671 5273

Experimental Class

	Well-formed Sentences						Mal-formed sentences					
	Before		After		Totals		Before		After		Totals	
	S's	T's	S's	T's	S's	T's	S's	T's	S's	T's	S's	T's
1	29	151	35	197	64	348	22	150	2	15	24	165
2	18	95	24	161	42	256	25	210	5	51	30	261
3	32	151	18	172	50	323	32	253	8	73	40	326
4	49	152	52	183	101	335	24	97	3	13	27	110
5	20	71	41	208	61	279	27	247	10	78	37	325
6	25	120	31	223	56	343	26	128	6	54	32	182
7	10	47	48	247	58	294	19	177	2	8	21	185
8	36	176	43	283	79	459	23	171	1	3	24	174
9	29	121	50	340	79	461	19	84	2	11	21	95
10	15	48	52	236	67	284	27	233	6	29	33	262
11	38	225	46	449	84	674	11	88	3	77	14	165
12	36	141	22	84	58	225	16	79	9	48	25	127
13	38	183	47	313	85	496	16	106	4	79	20	185
14	6	21	29	131	35	152	14	92	11	158	25	250
15	20	101	24	198	44	299	17	95	8	70	25	165
16	44	399	44	346	88	745	9	87	1	17	10	104
17	23	66	65	276	88	342	18	93	1	2	19	95
18	28	88	49	382	77	470	2	3	2	5	4	8
19	10	32	42	225	52	257	23	134	4	69	27	203
20	23	93	56	222	79	315	17	87	4	48	21	135
21	27	49	21	148	48	197	24	66	7	57	31	123
Totals	556	2530	839	5024	1395	7554	411	2680	99	965	510	3645

The analysis of the prose consisted of a reconstruction of the transformational history of each sentence. A well-formed sentence had to be not only intuitively acceptable to the analysts but also derivable from the rules of the grammar. A mal-formed sentence had to be not only intuitively unacceptable but also demonstrably undervivable. Analytical procedures were made as mechanical as possible. Summaries of frequencies of words, sentences, and transformations are presented in Tables 1 and 2.

Structural Complexity Scores

Each sentence in the sample was assigned a structural complexity score which represents the total number of grammatical operations it has taken to produce the sentence. Average structural complexity scores are presented in Tables 3 and 5.

The increase in average structural complexity scores for well-formed sentences was 3.793 for the control class and 9.315 for the experimental class. A difference of over 5 grammatical operations per sentence seems to indicate that the experimental class had significantly extended its capacity for producing complex well-formed sentences. However, a closer examination reveals that the greatest changes were made by only four students, one of whom shows a structural complexity increase of 64.741.

Table 3

Average Structural Complexity Scores for Well-formed Sentences

<u>Control Class</u>				<u>Experimental Class</u>			
	Before	After	Change		Before	After	Change
1	8.791	27.300	+18.509	1	8.305	11.198	+2.893
2	8.162	11.759	+ 3.597	2	9.516	14.640	+5.124
3	6.298	9.744	+ 3.446	3	8.510	13.727	+5.217
4	5.333	11.333	+ 6.0	4	5.382	6.836	+1.454
5	5.796	7.732	+ 1.936	5	5.845	10.942	+5.097
6	7.190	6.842	- .348	6	7.908	10.986	+3.078
7	7.903	10.710	+ 2.807	7	8.340	8.126	- .214
8	4.972	7.851	+ 2.879	8	7.449	29.800	+22.351
9	8.086	10.526	+ 2.44	9	6.942	13.300	+6.358
10	7.571	5.077	- 2.494	10	5.521	9.08	+3.559
11	6.196	8.786	+ 2.59	11	8.822	24.951	+16.129
12	5.753	12.360	+ 6.607	12	7.702	6.167	-1.535
13	6.740	11.322	+ 4.582	13	7.956	11.470	+3.514
14	5.103	13.896	+ 8.793	14	6.095	8.008	+1.913
15	5.917	8.645	+ 2.728	15	7.624	39.343	+31.810
16	6.378	15.051	+ 8.673	16	14.870	14.280	- .590
17	10.148	13.688	+ 3.540	17	5.576	8.217	+2.641
18	7.278	9.112	+ 1.834	18	5.966	70.707	+64.741
19	7.288	8.164	+ .876	19	5.969	13.476	+7.507
20	9.270	6.143	- 3.127	20	5.871	8.770	+2.899
				21	3.347	15.014	+11.667
Average	7.009	10.802	+3.793		7.310	16.625	+9.315

Statistical evaluation of change in average structural complexity scores for well-formed sentences by analysis of variance provides only minimal support for any contention that the increased average complexity scores in the experimental class can be attributed to the study of generative grammar.

Table 4

Well-formed Structural Complexity Scores: Statistical Summary				
Source	df	SS	MS	F
D	1	192.15	192.15	3.01
S's w/gps.	39	2490.13	68.85	
A	1	898.81	898.81	28.47**
A x D	1	156.16	156.16	4.95*
A x S's	78	2462.77	31.57	
*Significant at the .05 level			A: Before and After Scores	
**Significant at the .01 level			D: Control and Experimental Classes	

- Findings: (1) Statistical analysis fails to indicate a significant difference between the control and experimental classes. (D)
- (2) Before and After Gains Scores are significantly different at the .01 level. (A)
- (3) The interaction between (a) Before and After Gains Scores and (b) experimental and control classes is significant at the .05 level. (A x D)

- Comments: (1) Increase in average structural complexity scores is significantly different when Before and After scores are compared independently of control and experimental groups. Both classes have increased capacities for producing sentences of greater complexity.
- (2) That the A x D interaction score is significant at the .05 level indicates that increase in structural complexity scores depends not only on when a sample was written but also on whether it was written in the experimental or the control class.
- (3) Though there is a suggestion that the greater gain in average structural complexity score for the experimental class is dependent on the study of the grammar, the failure of the statistical analysis to indicate a significant difference between the two classes (D) considerably weakens this contention.

The increase in average structural complexity scores for mal-formed sentences was 7.511 for the control class and 3.585 for the experimental class. Table 4 indicates that as both classes learned to write well-formed sentences of increased complexity they also increased the average structural complexity of mal-formed sentences, though the experimental class was better able to hold this tendency in check.

Table 5

Average Structural Complexity Scores for Mal-formed Sentences

<u>Control Class</u>				<u>Experimental Class</u>			
	Before	After	Change		Before	After	Change
1	7.882	76.307	+68.425	1	9.973	8.800	- 1.173
2	10.0	19.795	+ 9.795	2	14.533	12.392	- 2.141
3	8.379	9.411	+ 1.032	3	12.553	13.233	+ .68
4	9.375	13.667	+ 4.292	4	7.103	5.692	- 1.411
5	10.148	11.765	+ 1.617	5	13.429	10.718	- 2.711
6	14.556	9.25	- 5.306	6	6.859	12.111	+ 5.252
7	9.711	21.298	+11.587	7	13.073	5.00	- 8.073
8	10.044	21.612	+11.568	8	11.678	4.00	- 7.678
9	14.621	15.757	+ 1.136	9	6.845	7.64	+ .795
10	7.224	15.528	+ 8.304	10	14.056	7.31	- 6.746
11	9.515	11.217	+ 1.702	11	10.045	36.65	+26.605
12	9.589	20.381	+10.792	12	6.385	7.792	+ 1.407
13	12.013	6.733	- 5.280	13	10.415	29.772	+19.357
14	7.986	12.982	+ 4.996	14	8.96	19.443	+10.483
15	8.337	11.036	+ 2.699	15	8.032	12.829	+ 4.797
16	16.658	24.717	+ 8.059	16	14.092	18.000	+ 3.908
17	11.819	17.353	+ 5.534	17	12.409	3.000	- 9.409
18	9.611	10.353	+ .742	18	2.667	4.400	+ 1.753
19	8.154	10.706	+ 2.552	19	8.746	24.812	+16.066
20	7.045	13.023	+ 5.978	20	7.20	25.792	+18.592
				21	5.000	9.965	+ 4.965
Average	10.133	17.644	+ 7.511		9.717	13.302	+ 3.585

Statistical analysis of average structural complexity scores for mal-formed sentences is unambiguous.

Table 6

Mal-formed Structural Complexity Scores: Statistical Summary				
Source	df	SS	MS	F
D	1	115.98	115.98	1.50
S's w/gps.	39	3005.15	77.06	
A	1	620.24	620.24	12.02**
A x D	1	78.93	78.93	1.53
A x S's	76	4026.16	51.62	
*Significant at the .05 level			A: Before and After Scores	
**Significant at the .01 level			D: Experimental and Control Classes	

- Findings: (1): The analysis fails to show a significant difference between the control and experimental classes. (D)
- (2): Before and After gains scores are significantly different at the .01 level.
- (3): The interaction between (a) Before and After gains scores and (b) experimental and control classes is not significant.

- Comments: (1) Increase in average structural complexity scores for mal-formed sentences is significantly different when before and after scores are compared independently of control and experimental classes. Both classes have increased average structural complexity scores significantly.
- (2) Since the analysis fails to show either a significant difference between the two classes (D) or a significant interaction effect (A x D), change in average structural complexity scores for mal-formed sentences cannot be said to be dependent upon the study of the grammar.

Proportion of Well-formed Sentences

Table 7 shows change in proportion of well-formed sentences. For the control class there is an increase of 3.5%; for the experimental class, 31.8%. It might seem unusual that the percentages of well-formed sentences in the Before writing were not higher (59.5% for the control class and 55.9% for the experimental class). These relatively low percentages reflect the rigor of the criteria for well-formedness. Customary compositional admonishments include such inexplicit judgments as "awkward," "vague," and other undefined terms that identify the grader's intuitive recognition of mal-formedness. In the analysis of the prose samples in this study, explicit grammatical demonstrations of intuitions of mal-formedness were required. It was not enough to recognize that a sentence was not well-formed: the exact character of the mal-formedness had to be explicitly attributed to malfunctions of phrase structure or transformational operations. A careful and detailed classification and sub-classification of errors led to an explicit definition of mal-formedness that could be applied in a quite mechanical way.

Table 7

Change in Proportion of Well-formed Sentences

<u>Control Class</u>			<u>Experimental Class</u>		
Before P	After P	Change	Before P	After P	Change
1	.639	.811	1	.569	.946
2	.786	.720	2	.419	.828
3	.455	.588	3	.500	.692
4	.750	.438	4	.671	.945
5	.517	.633	5	.426	.804
6	.677	.564	6	.490	.838
7	.645	.553	7	.345	.960
8	.717	.605	8	.610	.977
9	.568	.667	9	.604	.962
10	.674	.692	10	.357	.897
11	.412	.596	11	.776	.939
12	.488	.614	12	.692	.710
13	.438	.620	13	.704	.922
14	.625	.808	14	.300	.725
15	.581	.483	15	.541	.750
16	.613	.436	16	.830	.978
17	.469	.605	17	.561	.985
18	.581	.694	18	.933	.961
19	.809	.707	19	.303	.913
20	.452	.765	20	.575	.933
			21	.529	.750
Average	.595	.630		.559	.877

Analysis of variance applied to the gains scores for proportion of well-formed sentences provides the most unambiguous conclusions of the study.

Table 8

<u>Proportion of Well-formed Sentences: Statistical Summary</u>				
Source	df	SS	MS	F
D	1	1.68	1.68	15.27**
S's w/gpe.	39	4.34	.11	
A	1	3.82	3.82	119.38**
A x D	1	2.56	2.56	80.00**
A x S's	78	2.50	.032	
*Significant at the .05 level				
**Significant at the .01 level				
A: Before and After Scores				
D: Experimental and Control Classes				

- Findings: (1) There is a significant difference between the control and experimental classes at the .01 level. (D)
- (2) There is a significant difference between the Before and After scores at the .01 level. (A)
- (3) There is a significant interaction at the .01 level between (a) the Before and After scores and (b) the control and experimental classes.

- Comments: (1) The increased production of well-formed sentences by the experimental class is significantly greater than that of the control class.
- (2) The significant difference in the gains scores for proportion of well-formed sentences can unambiguously be attributed to the study of the grammar by the experimental class.

Error Change Scores

Tables 9 - 12 present changes in the frequency of the five classes of errors and total errors. Since the number of Before-sentences for both control and experimental classes is unequal to the After-sentences, the Before-frequencies for both classes have been adjusted so that Before- and After-tabulations can be meaningfully compared. Errors were classified as follows:

1. Mis-application of a transformational operation.
2. Use of one transformation when another is required.
3. Use of a transformation when none should have been used.
4. Omission of a required transformation.
5. Co-occurrence error: the use of mutually exclusive grammatical elements in kernel sentences or in kernel sentences underlying complex sentences.

Class 1 Errors

Table 9 shows Before (adjusted) and After frequencies of Class 1 Errors for control and experimental classes. Both classes were clearly able to reduce frequency of Class 1 Errors substantially. Average reduction for the

control class was 8.9 (39.82%) and for the experimental class 13.67 (79.06%). The greater reduction made by the experimental class would appear to be clearly significant, though statistical analysis is not unambiguous.

Table 9

Change in Frequency of Class 1 Errors

<u>Control Class</u>				<u>Experimental Class</u>			
	Before	After	Change		Before	After	Change
1	19	6	-13	1	15	3	-12
2	13	5	- 8	2	32	5	-27
3	47	20	-27	3	31	6	-25
4	27	16	-11	4	21	3	-18
5	27	13	-14	5	35	5	-30
6	19	17	- 2	6	29	4	-25
7	8	21	+13	7	25	1	-24
8	15	7	- 8	8	17	1	-16
9	24	14	-10	9	10	1	- 9
10	16	8	- 8	10	33	2	-31
11	35	14	-21	11	5	2	- 3
12	34	11	-23	12	8	2	- 6
13	31	22	- 9	13	14	4	-10
14	19	3	-16	14	16	15	- 1
15	11	15	+ 4	15	10	9	- 1
16	15	32	+17	16	9	1	- 8
17	16	14	- 2	17	20	1	-19
18	23	11	-12	18	2	1	- 1
19	6	10	+ 4	19	14	3	-11
20	42	10	-32	20	10	2	- 8
				21	7	5	- 2
Totals	447	269	-178		363	76	-287
Average	22.35	13.45	-8.9		17.29	3.62	-13.67
Percent of Error Reduction: 39.82%				79.06%			

Table 10

Error Change Scores (Class 1): Statistical Summary				
Source	SS	df	MS	F
A	2586.266	1	2586.266	33.536**
S(CD)	2930.521	38	77.119	
D	1094.934	1	1094.934	16.831**
A x D	115.286	1	115.286	1.772
A x S (CD)	2472.040	38	65.054	
Total	9199.046	79		
*Significant at the .05 level. A: Before and After Scores				
**Significant at the .01 level. D: Experimental and Control Classes				

Findings: (1) Before and After Gains Scores are significant at the .01 level. (A)

(2) There is a significant difference at the .01 level between the control and the experimental classes. (D)

(3) The analysis fails to show a significant interaction between (a) the Before and After scores and (b) the experimental and control classes.

Comments: (1) Decrease in production of Class 1 Errors is significantly different when Before and After scores are compared independently of control and experimental groups.

(2) Even though the control and experimental classes differ significantly, the absence of a significant interaction weakens any contention that the experimental class's greater reduction of Class 1 Errors was a result of studying the grammar.

(3) The clear relationship between increase in proportion of well-formed sentences and decrease in error production substantially supports the contention that the greater change of the experimental class is attributable to its study of the grammar.

Class 2, 3, and 4 Errors

The relative infrequency of errors in these classes suggested that statistical analysis would be undesirable. Table 11 shows Before (adjusted) and After frequencies of Class 2, 3, and 4 Errors. Class 2 Error reduction is the same for the experimental and control classes; the experimental class made considerably more Class 3 Errors in the Before-writing than the control class, though most of these errors were

eliminated in the After-writing; the control class made considerably more Class 4 Errors than the experimental class, though it substantially reduced them in the After-writing. The lack of correspondence between Class 3 and 4 Before Errors makes any kind of comparison of the experimental and control classes impossible.

Table 11

Change in Frequency of Class 2, 3, and 4 Errors

Class	<u>Control Class</u>			<u>Experimental Class</u>		
	Before	After	Change	Before	After	Change
2	37	15	-22	38	16	-22
3	18	15	- 3	43	5	-38
4	61	14	-47	6	14	+ 8

Class 5 Errors

Table 12 shows Before (adjusted) and After frequencies of Class 5 Errors for control and experimental classes. Both the experimental and the control classes were able to reduce frequency of Class 5 Errors substantially. Average reduction for the control class was 6.55 (51.78%) and for the experimental class 10.48 (91.29%). The greater reduction made by the experimental class would appear to be clearly significant, though statistical analysis is again not unambiguous.

Table 12

Change in Frequency of Class 5 Errors

<u>Control Class</u>			<u>Experimental Class</u>		
Before	After	Change	Before	After	Change
1	3	2	1	10	0
2	8	7	2	25	0
3	13	1	3	18	2
4	13	3	4	14	1
5	13	12	5	23	1
6	8	8	6	7	0
7	3	7	7	8	0
8	11	12	8	14	0
9	0	5	9	13	0
10	15	5	10	15	0
11	31	4	11	7	0
12	16	8	12	6	5
13	11	5	13	6	0
14	11	6	14	15	3
15	10	6	15	15	2
16	15	3	16	0	0
17	13	4	17	8	0
18	15	17	18	0	1
19	5	4	19	10	1
20	39	3	20	7	2
			21	20	3
Total					
	253	122		241	21
Average					
	12.65	6.1		11.48	1

Percent of Error Reduction: 51.78%

91.29%

Table 13

Error Change Scores (Class 5): Statistical Summary

Source	SS	df	MS	F
A	1433.362	1	1433.362	41.509**
S (CD)	1312.175	38	34.531	
D	187.970	1	187.970	5.126*
A x D	78.749	1	78.749	2.148
A x S (CD)	1393.447	38	36.670	
Total	4405.703	79		

*Significant at the .05 level. A: Before and After Scores

**Significant at the .01 level. D: Experimental and Control Classes

Findings: (1) There is a significant difference between the Before and After scores at the .01 level. (A)

(2) There is a significant difference between the control and experimental classes at the .05 level. (D)

(3) The analysis fails to show a significant interaction between (a) the Before and After scores and (b) the control and the experimental classes. (A x D)

Comments: (1) Decrease in production of Class 5 Errors is significant when Before and After scores are compared independently of experimental and control classes.

(2) Even though the control and experimental classes differ significantly at the .05 level, the absence of a significant interaction weakens any contention that the experimental class's greater reduction of Class 5 Errors is a result of studying the grammar.

(3) The clear relationship between increase in proportion of well-formed sentences and decrease in error production substantially supports the contention that the greater change of the experimental class is attributable to its study of the grammar. The greater significance of difference between the experimental class and the control class in respect to Class 1 Errors (.01) as opposed to Class 5 Errors (.05) suggests that the study of the grammar is more directly related to the reduction of Class 1 Errors. This tentative conclusion would receive logical support in that many co-occurrence errors seem to be pre-grammatical, involving a failure on the part of the writer to channel a partially formed idea through the grammatical component of his sentence generating device.

Total Errors

Table 14 shows Before (adjusted) and After frequencies of total errors. The control class reduced errors by 46.63% and the experimental class by 80.86%. As in the case of both Class 1 and Class 5 Errors, statistical analysis of Total Errors does not yield unambiguous results.

Table 14.

Change in Frequency of Total Errors

<u>Control Class</u>				<u>Experimental Class</u>			
	Before	After	Change		Before	After	Change
1	29	9	-20	1	31	4	-27
2	21	12	- 9	2	61	7	-54
3	82	21	-61	3	53	9	-44
4	44	22	-22	4	38	5	-33
5	45	27	-18	5	59	10	-49
6	32	29	- 3	6	38	6	-32
7	24	28	+ 4	7	37	2	-35
8	29	20	- 9	8	37	1	-36
9	29	22	- 7	9	25	2	-23
10	32	17	-15	10	55	6	-49
11	77	21	-56	11	11	4	-10
12	55	25	-30	12	18	11	- 7
13	47	27	-20	13	24	7	-17
14	34	10	-24	14	33	21	-12
15	26	45	+19	15	29	15	-14
16	32	18	-14	16	9	1	- 8
17	47	17	-30	17	28	1	-27
18	35	34	- 1	18	2	2	0
19	13	17	+ 4	19	41	5	-36
20	82	14	-68	20	22	4	-18
				21	36	9	-27
Totals	815	435	-380		690	132	-558
Average	40.75	21.75	-19.0		32.86	6.29	-26.57
Percent of Error Reduction: 46.63%				80.86%			

Table 15

Error Change Scores (Total): Statistical Summary

Source	df	SS	MS	
C	4	11022.898	2755.725	111.812**
D	1	538.770	538.770	21.860**
C x D	4	786.086	196.522	7.973**
S's w/gps	190	4682.731	24.646	
A	1	2079.944	2079.944	91.018**
C x A	4	1998.374	499.594	21.862**
D x A	1	56.078	56.078	2.453
C x D x A	4	188.516	47.129	2.062
A x S's w/gps	190	4341.808	22.852	

- Findings: (1) There are significant differences among the five classes of errors at the .01 level. (C)
- (2) There is a significant difference between the experimental and control classes at the .01 level. (D)
- (3) There is a significant interaction between (a) the classes of errors and (b) the experimental and control classes at the .01 level. (C x D)
- (4) There is a significant difference between the Before and After scores at the .01 level. (A)
- (5) There is a significant interaction between (a) the classes of errors and (b) the Before and After scores at the .01 level. (A x C)
- (6) There is no significant interaction between (a) the experimental and control classes and (b) the Before and After scores. (D x A)
- (7) There is no significant interaction between (a) the classes of errors, (b) the control and experimental classes, and (c) the Before and After scores. (C x D x A)

Comments: (1) Much the same comment can be made here as was made in regard to Class 1 and Class 5 Error reduction. The clear relationship between increase in proportion of well-formed sentences and decrease in error production substantially supports the contention that the greater change of the experimental class is attributable to its study of grammar. The statistical analysis of total errors is somewhat obfuscated by the fact the classes of errors factor (C) is a complex factor consisting of five sub-classes. Consequently, significant differences are dependent not only on Before and After scores of experimental and control classes but also on the sub-class of errors.

Proportions of Classes of Transformations in Well-formed Sentences

The detailed analysis of the prose samples included identification of every transformational operation in every sentence. Four data sheets were then prepared for each student (164 sheets): (1) Before well-formed sentences, (2) After well-formed sentences, (3) Before mal-formed sentences, and (4) After mal-formed sentences. Transformations were entered appropriately on each sheet in the position opposite the number of the specific transformation (1-46) and below the number representing the structural complexity score of the sentence in which the transformation occurred. Summaries were made according to the nine classes of transformations (Noun Expansion, Noun Replacement, Adjective Expansion, Verb Expansion, Adverbial Replacement, Adverbial Expansion, Conjoining, Deleting, and Simple) and proportions of classes of transformations were computed. Statistical evaluation of this information by analysis of variance indicated that there was a significant difference among the classes of transformations but that there was no significance between Before and After scores nor between the experimental and the control classes. In other words, it seems clear that the study of the grammar had no identifiable effect on the distribution of classes of transformations. Inspection of the data sheets suggests that further investigation of the frequency changes of individual transformations should be undertaken, though such an analysis of data is presently unfeasible.

Summary

The writing sample consisted of 70,000 words, 1731 sentences, and 8,533 transformations. Before and After average structural complexity scores for well-formed and mal-formed sentences, Before and After proportions of well-formed sentences, Before and After frequencies of five classes of errors, and Before and After proportions of nine classes of transformations were evaluated by analysis of variance.

The following conclusions seem justifiable:

(1) Structural Complexity Scores of Well-formed Sentences

Before and After gains scores are significant at the .01 level and the interaction score is significant at the .05 level. However, statistical analysis fails to indicate a significant difference between the control and the experimental classes.

No strong statistical claim can be made for attributing the greater gain of the experimental class to the study of the grammar, though inspection of the data (Table 3) and the consistently greater gains scores of the experimental class in the other comparisons is suggestive.

(2) Structural Complexity Scores of Mal-formed Sentences

Since statistical analysis fails to indicate either a significant difference between the experimental and the control classes or a significant interaction effect, change in average structural complexity scores of mal-formed sentences cannot be said to be dependent upon the study of the grammar.

(3) Proportion of Well-formed Sentences

Comparisons of Before and After scores, experimental and control classes, and interaction scores are all significant at the .01 level. The increase in production of well-formed sentences by the experimental class can unambiguously be attributed to the study of the grammar.

(4) Error Change Scores

Comparisons of Before and After scores and the experimental and control classes are significant at the .01 level. However, the analysis fails to indicate a significant interaction effect. The clear relationship between increase in proportion of well-formed sentences and decrease in error production substantially supports the claim that the greater change of the experimental class is attributable to its study of the grammar.

(5) Proportions of Classes of Transformations in Well-formed Sentences

When transformations were summarized by classes and changed to proportions, analysis of variance failed to indicate a significant difference between Before and After scores and between experimental and control classes. The inconclusiveness of this analysis and inspection of the data sheets suggest that further investigation of frequency changes of individual transformations should be undertaken.

5. CONCLUSIONS AND IMPLICATIONS

It seems clear that claims must be presented tentatively, regardless of the statistical level of significance, when the total population was limited to forty-one pupils. Even so, the persistently higher gains scores for the experimental class in every comparison made strengthens the contention that the study of a systematic grammar which is a theoretical model of the process of sentence production is the logical way to modify the process itself.

It should also be observed that University School classes are most certainly atypical. Even though criteria of internal validity were adequately met through careful randomization procedures, the sampling requirements needed to meet criteria of external validity could not be adequately fulfilled. Consequently, it must be stated quite unequivocally that even though the net effect of the statistical analysis would strongly support the rejection of the null hypothesis that a knowledge of generative grammar is unrelated to change in structural complexity scores, proportion of well-formed sentences, and error reduction scores, generalizations that reach beyond the scope of the sample are purely speculative. However, any failure to meet rigorous criteria of external validity should not lead one to dismiss the statistically significant results of an experiment in which criteria of internal validity were carefully attended to. The persistent tendency of researchers to conclude that a knowledge of grammar has no significant effect on language skills (when judgment should have been suspended) should certainly be re-examined.

Since the experiment depended on a knowledge of generative grammar, the pupils in the experimental class had to be sufficiently intelligent to understand the subject matter of the two-year program. Randomization procedures and statistical analysis presumably take into account the individual differences within and between classes; nevertheless, some account of the relative intelligence of the two classes should be helpful in any final evaluation of the experimental results. Stanford-Binet Intelligence Quotient scores were available for all experimental class pupils and all but two control class pupils. The average IQ of the control class was 115 with a range of 91 to 153; the average IQ of the experimental class was 118.2 with a range of 88 to 153. Of greater interest, however, is the apparent lack of correlation between IQ and amount of increase in proportion of well-formed sentences as is shown in Table 16.

One further comment regarding the manner in which the generative grammar was taught seems important. The phrase structure component of the grammar was studied by the experimental class throughout the first year of the experiment. It was therefore not possible to present the transformational materials until the second year. Consequently, there was little time to explore the rhetorical applications of the grammar. Any great change in average complexity scores or in distribution of either classes of transformations or individual transformations would quite possibly have required more time.

Table 16

Intelligence and Before and After Proportions of Well-formed Sentences

<u>Control Class</u>					<u>Experimental Class</u>				
	Before	After	Change	IQ		Before	After	Change	IQ
1.	.639	.811	+.172	(137)	1.	.569	.946	+.377	(138)
2.	.786	.720	-.066	(152)	2.	.419	.828	+.409	(112)
3.	.455	.588	+.133		3.	.500	.692	+.192	(098)
4.	.750	.438	-.312		4.	.671	.945	+.274	(126)
5.	.517	.633	+.116	(103)	5.	.426	.804	+.378	(134)
6.	.677	.564	-.113	(117)	6.	.490	.838	+.348	(104)
7.	.645	.553	-.092	(134)	7.	.345	.960	+.615	(123)
8.	.717	.605	-.112	(91)	8.	.610	.977	+.367	(115)
9.	.568	.667	+.099	(121)	9.	.604	.962	+.358	(138)
10.	.674	.692	+.018	(113)	10.	.357	.897	+.540	(097)
11.	.412	.596	+.184	(96)	11.	.776	.939	+.163	(122)
12.	.488	.614	+.126	(120)	12.	.692	.710	+.018	(124)
13.	.438	.620	+.182	(112)	13.	.704	.922	+.218	(153)
14.	.625	.808	+.183	(99)	14.	.300	.725	+.425	(088)
15.	.581	.483	-.098	(105)	15.	.541	.750	+.209	(115)
16.	.613	.436	-.177	(102)	16.	.830	.978	+.148	(133)
17.	.469	.605	+.136	(153)	17.	.561	.985	+.424	(094)
18.	.581	.614	+.113	(121)	18.	.933	.961	+.028	(112)
19.	.809	.707	-.102	(093)	19.	.303	.913	+.610	(103)
20.	.452	.765	+.313	(101)	20.	.575	.933	+.358	(126)
					21.	.529	.750	+.221	(127)

Conclusions of the Study:

1. High school students can learn the principles of generative grammar relatively easily because of its consistency, specificity, and relevance to well-formed sentence production.
2. A knowledge of generative grammar enables students to increase significantly the proportion of well-formed sentences they write.
3. Statistical analysis suggests, but does not prove, that there is a relation between a knowledge of generative grammar and an ability to produce well-formed sentences of greater structural complexity. Because the experimental subjects increased the average complexity scores in well-formed sentences to a greater degree than did the control subjects, and because the control subjects increased the average complexity scores in mal-formed sentences to a greater degree than did the experimental subjects, there is a strong inference that it was the knowledge of the generative grammar that enabled the experimental subjects to increase the complexity without sacrificing the grammaticality of their sentences.
4. When rigorous criteria of well-formedness are applied in the analysis of writing samples, results show that almost half of the sentences written by the ninth graders were mal-formed. This finding runs counter to the wide-spread contention of the structural linguist, who is not concerned with well-formedness as a grammatical goal, that children have acquired virtually full command of the grammar of English at an early age. The more likely contention is that the grammar of English is never fully mastered.
5. A knowledge of generative grammar can enable students to reduce the occurrence of errors in their writing.

Implications for further study:

1. The dramatic changes in the writing of the experimental class strongly support the contention that a generative grammar does in fact represent the process of sentence formation. This contention is receiving considerable empirical support in current psycholinguistic research. Further research in psycholinguistics and in the teaching of generative grammar may make it possible to identify not only a clearly defined set of psychological operations that have relevance to the composing process but also an analogous set of logical descriptions that would provide a significant structure for composition programs. At the same time it might also be possible to identify sets of grammatical mis-operations that characterize the writing of children at different age levels. A scale of expected compositional behavior for children of different ages could be constructed by using a detailed analytical device of the sort described in this study. The explicit description of grammatical operations and mis-operations could then provide a basis for developing packages of compositional materials to be used at the different grade levels.

2. The use of transformational theory in developing instructional units for the experimental class focusses concern on the well-formedness or grammaticality of written sentences. Those analyses which list or identify all grammatical structures without distinguishing well-formed from malformed sentences - models from structural linguistics, for example - do not really provide the composition teacher with useful characterizations of grammaticality.

3. This analysis of prose made use of an instrument that identified forty-six transformational operations for producing sentences. The more precise the analytical instrument, presumably the more precise the description of

writing will be. The corollary suggests that those attempts to relate maturity of written expression to a single index - like sentence length, clause length, frequency of subordinate clauses - are not likely to produce valid estimates of writing maturity, let alone precise descriptions of the writing.

4. Generalizations beyond this limited sample must be thought of as speculations. Nevertheless, it seems clear that this study provides a strong motivation for systematically investigating such speculations.

More immediate answers are needed to such questions as the following:

- (a) Could this study be replicated in communities which differed culturally and economically?
- (b) Could generative grammar be taught in the elementary grades?
- (c) If a class had more time to make systematic applications of the generative grammar to rhetorical matters would there be greater differences in Before and After Gains Scores? The development of more economical methods for presenting a generative grammar to students clearly indicates that a pedagogically complete generative grammar could be taught in much less than two academic years.